INGÉNIEUR ENSEEIHT INFORMATIQUE ET TÉLÉCOMMUNICATIONS

IN BRIEF

Type of diploma : Diplôme d'ingénieur
Ministry field : Sciences, Ingénierie et Technologies

MORE INFO

ECTS credits : 180

Level : BAC +5

Type of education
* Formation initiale

Kind of education : Diplôme

LEARN MORE

http://www.enseeiht.fr/fr/index.html

Presentation

Le cycle ingénieur comporte un total de 6 semestres : 5 semestres de cours, travaux dirigés, travaux pratiques et projets dans les différentes matières ; 1 semestre de Projet de Fin d'Etudes (PFE) réalisé en relation avec le milieu industriel (dernier semestre du cycle ingénieur). Durant les semestres académiques, la formation est structurée en Unités d'Enseignement (UE) auxquelles sont associés des crédits ECTS. La validation d'une année est conditionnée par l'obtention de 60 crédits ECTS.

Au cours du cycle ingénieur les étudiants doivent effectuer :

- un stage d'une durée de 6 semaines au moins à la fin de la première année (juin, juillet, août). ;

- un stage d'une durée de 8 semaines au moins à la fin de la deuxième année (juin, juillet, août) ;

- un Projet de Fin d'Etudes : ce projet se déroule sur une période de 20 semaines au moins au cours du deuxième semestre de la dernière année du cycle ingénieur. Proposé par le milieu industriel et/ou de la recherche, il est encadré par les industriels et/ou les chercheurs concernés et suivi par les enseignants de l'ENSEEIHT.

Pour l'obtention du diplôme, les étudiants devront :

-obtenir 300 crédits ECTS ;

- justifier un niveau d'anglais certifié équivalent au niveau européen B2 ;

- avoir effectué un séjour à l'étranger d'une durée d'au moins 16 semaines soit sous la forme d'un ou plusieurs stages, soit sous la forme d'un séjour détudes dans une université partenaire.

L'obtention d'un diplôme d'ingénieur ENSEEIHT, quelle que soit la discipline, implique les qualités suivantes :

-Maitrise des méthodes et outils de l'ingénieur et d'un large champ disciplinaire.

-Capacité à concevoir, réaliser et valider des solutions, des méthodes,des produits, des systèmes et des services.

-Aptitude à innover, entreprendre, collecter et intégrer des savoirs et à mener des projets de recherche.

-Maitrise des enjeux de l'entreprise relatifs à son fonctionnement dans ses dimensions économique, juridique, environnementale et sociétale.

-Aptitude à s'intégrer et à travailler au sein d'une organisation multiculturelle et internationale.

-Savoir gérer sa formation et sa carrière professionnelle.

L'ingénieur INP-ENSEEIHT "Informatique et Télécommunications" est un ingénieur de haut niveau technique et scientifique par la formation qu'il a suivie dans les domaines de l'informatique, des mathématiques, des télécommunications et des réseaux.

Grace au socle commun de formation, l'ingénieur INP-ENSSEEIHT "Informatique et Télécomminications" :

-Maitrise les principes de conception et de fonctionnement d'un ordinateur, au niveau de son architecture, de son système d'exploitation, et de ses modèles de programmation.

-Maitrise les différentes méthodes de développement logiciel, le respect du cahier des charges et de la qualité.

-Maitrise les techniques associées aux éléments d'une chaîne de communication numérique : les protocoles, la conception, le déploiement, la sécurisation et l'optimisation d'un réseau.

-Connait les mathématiques et l'algorithmique pour modéliser et résoudre des problèmes et extraire l'information pertinente des données massives structurées ou non.

-Maitrise une infrastructure informatique, les concepts et technologies internet, le développement d'une application mobile et multimédia.

-Maitrise la conception d'une architecture de réseau et les différents niveaux d'intercation des éléments la constituant.

Selon son parcours dans la spécialité, l'ingénieur INP-ENSEEIHT "Informatique et Télécommunications" :

-Identifie, modélise et analyse un problème complexe, nécessitant le recours à des outils et méthodes informatiques et numériques ; propose, teste et valide ses solutions.

-Conçoit et exploite l'architecture d'un système complexe, tout en intégrant les enjeux de qualité et sécurisation du système.

-Elabore, met en oeuvre et évalue des algorithmes séquentiels ou parallèles, en vue de la résolution de problèmes de calcul scientifique, de traitement et d'analyse de données.

-Conçoit et met en oeuvre des technologies internet, réseaux et mobiles, des systèmes multimédia innovants, éventuellement distribués et interactifs.

-Conçoit, dimensionne et exploite l'infrastructure d'un réseau de communication en vue d'échanger des données de tous types.

Compétences détaillées :

-Comprendre, analyser et concevoir des systèmes de communications de la couche physique à la couche transport pour réaliser un dimensionnement système de bout-en-bout

-Analyser et concevoir une chaîne de communication numérique en développant et implémentant les algorithmes de traitement du signal nécessaires en réception et les algorithmes d'optimisation utilisés pour l'allocation de ressources afin de répondre aux exigences système

-Modéliser, concevoir et développer un réseau de communication, notamment sans fil, offrant une qualité de service adaptée aux besoins applicatifs (application aux réseaux mobiles, réseaux ad-hoc et IoT)

-Conduire des projets en respectant les contraintes du cahier des charges, en utilisant des outils appropriés, dans un cadre collaboratif et communiquer les résultats en s'adaptant au public visé

-Concevoir un système cyberphysique composé d'applications et de réseaux de communication pouvant intégrer des contraintes temps-réel et liées à la sûreté de fonctionnement pour assurer le fonctionnement fiable et performant de systèmes embarqués ou d'applications industrielles

-Programmer et configurer un système cyberphysique composé d'applications et de réseaux de communication pour assurer le déploiement de façon fiable et performante sur des architectures matérielles dédiées aux systèmes embarqués ou aux applications industrielles, tout en intégrant des contraintes temps-réel et/ou liées à la sûreté de fonctionnement

-Valider et vérifier un système cyberphysique composé d'applications et de réseaux de communication afin de certifier et assurer un niveau de sûreté de fonctionnement adapté aux systèmes embarqués ou aux applications industrielles, avec des méthodes analytiques et des méthodes de test de vérification et validation.

-Modélisation, conception et développement d'une infrastructure de communication capable de passer à une échelle de plusieurs milliards de noeuds pour répondre aux exigences de l'internet des objets

-Concevoir et réaliser des architectures de réseau-système (réseau d'entreprise, d'opérateur, de data-center, ...) dans le but d'offrir un fonctionnement robuste et perenne

-Concevoir des infrastructures système et réseau dans le but de répondre aux exigences du domaine d'application (IA, IoT, ...) en termes de performances et évolutivité

-Exploiter et modéliser des données ou des algorithmes complexes passant à l'échelle à travers l'étude de systèmes temps réels, embarqués, répartis, distribués, mobiles, hétérogènes ou par apprentissage à base de données pour construire des systèmes logiciels de confiance

-Développer des systèmes logiciels en mettant en oeuvre des méthodes et techniques rigoureuses de développement et d'analyse pour des applications et des systèmes critiques

-Construire des outils logiciels (IDE, langages, systèmes, middleware, framework, etc) et les processus et méthodes associés nécessaires au développement de systèmes logiciels, matériels ou hybrides

-Traiter et analyser des contenus visuels, sensoriels et/ou temporels pour extraire des informations pertinentes à partir d'images, d'objets 3D, audio ou vidéo en mettant en oeuvre des méthodes d'optimisation et/ou d'apprentissage, ou des outils d'aide à la décision

Concevoir des systèmes multimédia interactifs (son, image, environnement 3D) pour envisager des applications immersives ou autonomes, en tenant compte de contraintes de temps réel et de passage à l'échelle

-Synthétiser des réalités mixtes (réalité augmentée, virtuelle, diminuée) pour interagir de façon efficace et avisée avec des mondes réels ou virtuels 2D, 3D en implémentant des algorithmes sur des architectures matérielles et logicielles

-Développer et optimiser des codes de calcul intensif, robustes et fiables, en exploitant les architectures modernes (CPU, GPU, multi-coeurs, multi-processeurs à mémoire distribuée et/ou partagée, ...), pour adresser les challenges de l'exa-scale computing, du green-computing

-Implémenter des méthodes mathématiques pour concevoir des outils pour la simulation numérique ou le contrôle de systèmes, exploités par des spécialistes métiers dans des contextes variés (ondes, me´canique des fluides ou des structures, finance, spatial, biologie, commande des systèmes, automates, ...)

-Analyser et traiter des données, potentiellement massives et liées, par des méthodes statistiques ou déterministes, dans le but de prédire ou d'expliquer des événements

--Concevoir et analyser des systèmes, en particulier d'exploitation, et des logiciels sécurisés par des méthodes et techniques préventives et palliatives pour des applications et standards en ingénierie système

Concevoir et déployer des systèmes de communications par des méthodes et techniques préventives et palliatives pour des réseaux filaires ou non filaires sécurisés

-Élaborer et sécuriser des architectures matérielles avec des déploiements sur différents supports (processeurs, calculateurs embarqués, antennes, téléphones) en mettant en oeuvre des méthodes et techniques préventives et palliatives pour les adapter à des applications en ingénierie et transport

-Développer sa réflexivité, en particulier la connaissance de soi, prototyper sur les principes de design thinking dans un cycle vertueux. Evaluer son bien-être, physique, mental et social, à gérer ses émotions et celles des autres, à être résilient et persévérer pour atteindre des objectifs d'un projet dans un contexte volatile, incertain, complexe, ambigu (VUCA), veiller au bien-être (physique, mental, social) et à l'épanouissement de ses collaborateurs et de soi-même.

-Construire son réseau professionnel via des outils et des techniques de branding personnel et de e-réputation, pour se représenter et représenter la profession d'ingénieur en tant qu'ambassadeur, faire rayonner auprès de publics divers le rôle et la fonction de l'ingénieur.e dans le respect de l'éthique, de la multiculturalité, de la diversité, du développement durable et de la responsabilité sociétale.

-Faire preuve de créativité et d'innovation, d'esprit d'entreprise, d'ouverture d'esprit, de conscience critique, de sens des responsabilités, d'engagement, pour développer des solutions respectueuses des transitions sociales et environnementales.

Training content

L'organisation des études sous statut étudiant (FISE) est assurée sur la base d'un plein temps. Le volume est d'environ 400 heures encadrées par semestre en moyenne sur les 3 années du cycle ingénieur.

Organization

Ingénieur ENSEEIHT Informatique et Télécommunications 1ère année
Ingénieur ENSEEIHT Informatique et Télécommunications 2ème année
Ingénieur ENSEEIHT Informatique et Télécommunications 3ème année

Access conditions

Selon les termes de son règlement, fixé chaque année en accord avec le Ministère chargé de l'éducation nationale, l'ENSEEIHT recrute environ 380 élèves par an sous statut étudiant dont 170 dans la spécialisation Informatique et Télécommunications.

3.3.1 La majorité des étudiants recrutés en première année (78% environ) sont les lauréats de concours nationaux (Concours Communs INP) présentés à l'issue de 2 années de Classes Préparatoires aux Grandes Ecoles (CPGE). Les CPGE constituent une formation supérieure fondamentale en matières théoriques scientifiques (mathématiques, physique, technologie, sciences de l'ingénieur) axquelles s'ajoute un enseignement en français et en langues étrangères. 10% des étudiants reçus au baccalauréat scientifique sont admis dans les CPGE. Le rythme de travail y est très soutenu : plus de 60 heures par semaine entre les cours et le travail personnel. La formation en CPGE correspond à 120 crédits ECTS.

3.3.2 Des élèves ingénieurs sont recrutés en première année sur le concours du cycle préparatoire La Prépa des INP, préparé dans les INP de France (10% environ des étudiants).

3.3.3 Après un concours sur titres, l'accès est autorisé en première année à des étudiants titulaires d'une deuxième année de Licence ou d'un DUT (12% environ des étudiants).

3.3.4 Après un concours sur titres, l'accès est également autorisé en deuxième année de l'ENSEEIHT (semestre 7 du cursus d'études supérieures) à des étudiants titulaires d'une première année de Master, ou d'un diplôme étranger équivalent, pour un cycle de 4 semestres (2 années) d'études conduisant à l'obtention du diplôme d'ingénieur (5% environ de l'effectif de 2ème année).

3.3.5 Le même cursus, conduisant au diplôme d'ingénieur, peut également être suivi en alternance sous statut apprenti (20 élèves environ par an).

Organizational unit

École Nationale Supérieure d'Électrotechnique d'Électronique d'Informatique d'Hydraulique et des Télécommunications

Places

Toulouse

Administrative contact(s)

n7@enseeiht.fr

Ingénieur ENSEEIHT Informatique et Télécommunications 1ère année

MORE INFO

ECTS credits : 60

Organization

· Année 1A SN - FISE

· Sem.5-1A SN-FISE

· Teaching Unit Soft and Human Skills

Person(s) in charge
HULL ALEXANDRA

· Subject Anglais

Pre-requisites

Aucun.

Objectives

Perform key oral and written workplace tasks in English.

Targeted skills

1) Chair a meeting in English.

2) Write an email and meeting minutes in English.

3) Write a CV & an application letter in English.

Description

A semester of 12 weekly sessions to develop English intercultural communication competencies for professional purposes.

Number of hours
21 hours

Teaching method
En présence

Teaching language
Anglais

Bibliography

* Palmer, A. (2013). *Talk Lean: Shorter Meetings. Quicker Results. Better Relations*. John Wiley & Sons.
* Benson, D. (2011). *The Art of Taking Minutes.* AmazonEncore.

* Reed, J. (2019). *The 7 Second CV: How to Land the Interview.* Penguin.

* Rubin, D (2015). *Wait, How Do I Write This Email?* News To Live By LLC.

· Second language

Choice: 1 Among 1 :

· Subject Spanish

· Subject Portuguese

· Subject Chinese

· Subject Italian

· Subject Japonese

· Subject Russian

· Subject German

· Subject French as a Foreign Language

· Subject Sports

· Subject Leadership and management

Pre-requisites

None.

Objectives

Develop key professional competencies to communicate effectively, manage projects and work in international teams.

Targeted skills

1) Develop self-knowledge by using preference tools and indicators such as Myers Briggs

2) Analyze the concept of ereputation and risks of social networking. Develop a professional online profile with tools such as LinkedIn.

3) Present yourself effectively in a telephone interview.

4) Define your teamwork preferences and profile by using tools and indicators such as Belbin; analyze risks and challenges such as intercultural communication, diversity, conflict management.

5) Complete a teamwork proposal; analyze a peer project proposal.

Description

1 semester of 12 weekly sessions aimed to develop your personal professional project.

Number of hours

21 hours

Person(s) in charge
HULL ALEXANDRA

Teaching method
En présence

Teaching language
French and English

Bibliography

* Burnett, W., & Evans, D. J. (2016). *Designing your life: How to build a well-lived, joyful life*. Knopf.
* Covey, S. R. (1989). *The 7 Habits of Highly Effective People*. Simon & Schuster.
* Lencioni, P. (2006). *The five dysfunctions of a team*. John Wiley & Sons.
* Furnham, A. (1996). The big five versus the big four: the relationship between the Myers-Briggs Type Indicator (MBTI) and NEO-PI five factor model of personality. *Personality and Individual Differences*, *21*(2), 303-307.

· Teaching Unit PROGRAMMATION IMPERATIVE

Person(s) in charge
AIT AMEUR YAMINE

· Subject Programmation Impérative 1

Objectives

Specify, define and test a program using an imperative programing langage offering modularity and genericity.

Targeted skills

Know how to design an algorithm using the successive refinments method in a imperative programing context (sequence, repetitions, conditionals, arrays, records, enumerations, pointers).

Know how to specify, define and test sub-programs (functions and procedures) and modules, possibly using genericity principles.

Understand and know how to use and write state-of-the-art algorithms (sort, search, etc.) and data structures (pile, file, lists, trees, etc.).

Description

Core concepts of imperative programing are taught and manipulated using a pseudo-langage for recitation classes and using ADA for labs.

These concepts are: imperative algorithmics (sequence, repetitions, conditionals), refinement method, sub-program decomposition (procedures and functions) and programing modules, data structures (arrays, records, enumerations, linked structures), genericity, recursivity, tests, offensive programming (by contract) and defensive (exceptions), abstract data types, dynamic memory allocation.

Person(s) in charge
AIT AMEUR YAMINE

Teaching method
En présence

Teaching language
Français

· Subject Programmation Impérative 2

Pre-requisites

Programmation Impérative 1.

Students are asked to apply the core concepts of Programmation Impérative 1 in a larger programing project in ADA.

Objectives

Specify, define and test a program using an imperative programing langage offering modularity and genericity.

Targeted skills

Know how to design an algorithm using the successive refinments method in a imperative programing context (sequence, repetitions, conditionals, arrays, records, enumerations, pointers).

Know how to specify, define and test sub-programs (functions and procedures) and modules, possibly using genericity principles.

Understand and know how to use and write state-of-the-art algorithms (sort, search, etc.) and data structures (pile, file, lists, trees, etc.).

Description

Core concepts of imperative programing are taught and manipulated using a pseudo-langage for recitation classes and using ADA for labs.

These concepts are: imperative algorithmics (sequence, repetitions, conditionals), refinement method, sub-program decomposition (procedures and functions) and programing modules, data structures (arrays, records, enumerations, linked structures), genericity, recursivity, tests, offensive programming (by contract) and defensive (exceptions), abstract data types, dynamic memory allocation.

Person(s) in charge
AIT AMEUR YAMINE

Teaching method
En présence

Teaching language
Français

· Teaching Unit INTEGRATION ET APPLICATIONS - PROBABILITES

Objectives

The first objective of this UE is to complement the knowledge of the first year students in the area of probabilities, with the study of continuous random variables and Gaussian vectors and the definition of convergence for a sequence of random variables. This knowledge will be required for other courses such as statistics, signal processing and data analysis. The second objective of this UE is to introduce measure theory with a particular focus on the Fourier transform and the theory of distributions, which will used in course devoted to signal processing and telecommunications.

Person(s) in charge
TOURNERET JEAN-YVES

· Subject Intégration et Applications

Objectives

To give the mathematical basis essential to any engineer concerning the theory of measurement, integration and the Fourier transform. These basics will be useful in several courses such as signal processing, image processing, telecommunications, data analysis, partial differential equations,...

Targeted skills

To know and manipulate the basic mathematical tools used in various other disciplines (PDE, signal and image processing,...

Description

* Introduction to measure theory

* Construction of the Lebesgue integral

* Main integration theorems (dominated convergende, Fubini,...)

* Fourier transform in L1/L2

* Convolution, filtering

* Distributions, Fourier transform of distributions.

Person(s) in charge
GRATTON SERGE

Bibliography

Analyse de Fourier et Applications - Auteusr : C. Gasquet, P. Witomski - Editeur : Masson , 1995

· Subject Probabilités

Pre-requisites

Probability bases (conditional probabilities, theorem of total probabilities, Bayes theorem), Calculus of integrals and series, change of variables, basic elements of linear algebra

Objectives

Understand how to define discrete and continuous random variables and the related basic tools (mathematical expectation, probability density function, cumulative distribution function, characteristic function, change of variables)

Understand how to define random vectors and how to compute marginal distributions, conditional distributions, mathematical expectations with a particular interest to the covariance and the correlation coefficient. Understand the different steps required for changes of variables for random vectors.

Understand how standard probabilistic notions simplify for random Gaussian vectors (margins and conditional distributions, affine transformations, independence). Introduce chi-square, Student and Fisher distributions.

Understand the different notions of convergence (in distribution, in probability, in the mean square sense) and the interest of the law of large numbers and the central limit theorem.

Targeted skills

Computation of probabilities for random variables and vectors

Properties of Gaussian vectors

Notions of convergence for sequences of random variables

Description

- Definition of a probability space
- Discrete and continuous random variables

- Random vectors
- Gaussian vectors
- Convergence and limit theorems

Number of hours
6 lectures of 1h45 + 4 exercice sessions of 1h45 + 3 practical sessions of 1h45

Person(s) in charge
TOURNERET Jean-yves
Jean-Yves.Tourneret@enseeiht.fr
Phone 2224

CHARVILLAT Vincent
vincent.charvillat@enseeiht.fr
Phone 2171

TOURNERET JEAN-YVES

Teaching method
En présence

Teaching language
French

Bibliography
1 . Athanasios Papoulis and S. Unnikrishna Pillai, Probability, Random Variable and Stochastic Processes, McGraw Hill Higher Education, 4th edition, 2002.

· Teaching Unit ANALYSE NUMERIQUE ET STATISTIQUES

Objectives

The first objective of this UE is to introduce the basic elements of statistics devoted to parameter estimation and hypothesis testing. The second objective of this UE is to study the first results on optimisation theory and partial derivative equations. These notions will be used in several courses taught in the first and second year of the department digital sciences.

Person(s) in charge
TOURNERET JEAN-YVES

· Subject Optimisation - E.D.P.

Pre-requisites

Linear algebra, calculus of derivatives, analysis

Objectives

Partial Differential Equations

The aim is to understand and predict the behavior of complex systems, such as those from physics (weather, mechanics, etc.). The modeling of these problems involves ordinary differential equations (ODE), but also partial differential equations (PDE). The analysis of these models involves the study of the existence and uniqueness of solutions, the discretization of the problem and the resulting loss of information, as well as the resolution of the discrete problem with its numerical aspects.

Optimization

A taxonomy of optimization problems will be presented, in order to be able to situate a problem in relation to the theoretical and numerical tools used to solve the problems. Then, the different relations between the extrema of a derivable function (zero gradient, inertia of the Hessian matrix in the unconstrained case) will be developed, insisting on the rigorous application of the available necessary and sufficient conditions. The emphasis is on understanding the structure of the problem and the precise use of the mathematical conditions.

Description

Partial Differential Equations

- Examples of PDE problems - Taxonomy;

- Finite difference method:

  - Presentation of the method;

  - Consistency of the numerical scheme;

  - Stability and convergence of numerical schemes for evolution problems.

Optimization

- Example problems and mathematical modeling;

- Definition and classification of optimization problems;

- Differentiability of applications, limited developments;

- Convexity of applications, characterization by properties of derivatives;

- Existence and uniqueness of solutions of optimization problems;

- Necessary and sufficient conditions for local optimum for unconstrained problems;

- Solving least squares problems - introduction of Newton and Gauss-Newton methods.

Person(s) in charge
RUIZ DANIEL

Bibliography

Brigitte Lucquin, Equations aux dérivées partielles et leurs approximations, Ellipse, 2004.

Jean-Baptiste Hiriart-Urruty, L'Optimisation. Que sais-je. Presses Universitaires de France, 1996.

Claude Ramis, Claude Deschamps et Jacques Odoux, Le cours de mathématiques - T3 Topologie et éléments d'analyse - 3e édition, Dunod, 2017

· Subject Statistiques

Pre-requisites

Bases of probability theory, computation of integrals and series, bases of optimization theory and of linear algebra

Objectives

Understand how to define a statistical model, to determine the main properties of estimators of the model parameters and finally to implement standard estimation methods (maximum likelihood, methods of moments, Bayesian estimators, confidence intervals)

Understand the concept of statistical test, how we can evaluate the performance of a test and how the Neyman Pearson theorem can be applied to binary hypothesis problems.

Understand the principles of goodness of fit tests (chi-square and Kolmogorov)

Targeted skills

Principles of statistical estimation and of hypothesis testing

Description

Estimation

- Statistical model and properties of estimators

- Cramér-Rao inequality

- Maximum likelihood

- Method of Moments

- Bayesian estimation

- Confidence intervals

Binary hypothesis tests

- Probability of false alarm, of detection and receiver operational characteristics (ROCs)

- Neyman Pearson theorem

- Chi-square and Kolmogorov tests

Number of hours
6 lectures of 1h45 + 4 exercice sessions of 1h45 + 3 practical sessions of 1h45

Person(s) in charge
TOURNERET Jean-yves
Jean-Yves.Tourneret@enseeiht.fr
Phone 2224

CHARVILLAT Vincent
vincent.charvillat@enseeiht.fr
Phone 2171

TOURNERET JEAN-YVES

Teaching method
En présence

Teaching language
french

Bibliography

Athanasios Papoulis and S. Unnikrishna Pillai, Probability, Random Variable and Stochastic Processes, McGraw Hill Higher Education, 4th edition, 2002.

· Teaching Unit TRAITEMENT DU SIGNAL ET AUTOMATIQUE

· Subject Traitement du Signal

Pre-requisites

Bases on deterministic signals (energy, power, periodicity)

Random variables and vectors

Objectives

Two parts in this course: 1) Introduce theoretical tools for signal processing, 2) Digital signal processing (implementation).

Objectives for the first part (theoretical tools) :

- Understand the different classes of deterministic and random signals with the definitions of the autocorrelation function and the power spectrum density

- Understand the concept of linear filtering and the Wiener Lee relationships

- Understand the principles of sampling and the Shannon theorem

- Understand the interest of non-linear transformations applied to deterministic and random signals and how to apply Price's theorem

Objectives for the second part (digital signal processing) :

- To be able to correctly sample a signal and to generate simple digital signals.

- To be able to estimate digitally the aucorrelation function and to perform a frequency representation (Fourier transform, Power Spectral Density) of a signal.

- To be able to determine impulse responses for simple filters (Finite Impulse Response, or FIR, filters) and to synthesize them, meaning to choose their parameters to meet some requirements.

- To be able to filter a signal and to analyze the obtained result.

Targeted skills

For the first part (theoretical tools) :

Computation of autocorrelation functions and power spectrum densities for deterministic signals and stationary random processes

Shannon theorem

Compute the autocorrelation function and the power spectrum density at the ouput of a linear filter

Apply Price's theorem to stationary random processes

For the second part (digital signal processing) :

- Perform a basic signal analysis using digital estimations in terms of autocorrelation function, Fourier Transform, Power Spectral Density.

- Implement simple digital filters (FIR) to analyze, generate or modify signals.

Description

For the first part (theoretical tools) :

- Autocorrelation and power spectral density

- Sampling

- Linear Filtering

- Non-linear transformations and Price's theorem

For the second part (digital signal processing) :

- Sampling and quantization.

- From theoretical to digital tools for the autocorrelation function and the Fourier transform : what are the approximations to be done ? what are their consequences ?

- Digital filters (FIR and IIR) and FIR synthesis.

Number of hours
7 lectures, 7 sessions of practical work

Person(s) in charge
THOMAS Nathalie
Nathalie.Thomas@enseeiht.fr
Phone 2236

TOURNERET Jean-yves
Jean-Yves.Tourneret@enseeiht.fr
Phone 2224

THOMAS NATHALIE

Teaching method
En présence

Teaching language
french

Bibliography

- Athanasios Papoulis and S. Unnikrishna Pillai, Probability, Random Variable and Stochastic Processes, McGraw Hill Higher Education, 4th edition, 2002.

- Simon Haykin and Barry Van Veen, Signal and Systems, Wiley Alan V. Oppenheim and Ronald W. Schafer, Digital Signal Processing, Prentice-Hall.

· Subject Automatique

Person(s) in charge
SINGH NEERAJ

· Teaching Unit SOUTIEN-1A-SN - Semestre 5

Optional :

· Subject Soutien en Mathématique - 1A SN - Semestre 5

· Subject Environnement Informatique

· Teaching Unit MODELISATION ET ARCHITECTURE

Person(s) in charge
PANTEL MARC

· Subject Architecture des Ordinateurs

Pre-requisites

Basics of Boolean logic

Objectives

- master a hardware description language

- know how to analyze and design a combinatorial logic or arithmetic circuit

- know how to analyze and design a synchronous sequential circuit

- know how to realize a wired algorithm with a sequential circuit

Targeted skills

- mastery of a hardware description language

- know how to analyze and design a combinatorial logic or arithmetic circuit

- know how to analyze and design a synchronous sequential circuit

- know how to realize a wired algorithm with a sequential circuit

Description

- introduction to Boolean logic

- introduction to binary arithmetic: 2's complement, fixed point, floating point, basic arithmetic operations

- introduction to the analysis and design of combinatorial logic and arithmetic circuits

- introduction to the analysis and design of sequential circuits

- construction of wired algorithms

- architecture of a processor

Person(s) in charge
BUISSON JEAN CHRISTOPHE

Bibliography

- Hennessy J., Patterson D. - Computer Organization and Design - Morgan Kaufman

- Brock J. LaMeres - Introduction to Logic Circuits & Logic Design with VHDL, Springer

· Subject Modélisation

Objectives

To discover, understand and know how to use the mathematical tools necessary for formal modeling of programming: logic and language theory. The subject covers both theoretical and practical aspects through the exploitation of state-of-the-art tools for formalization and proof of programs, and the use of formal description of languages for the exploitation of structural information.

Targeted skills

Modeling requirements using logic.

Modeling of programs and their correction with respect to requirements using logic.

Modeling languages based on regular expressions and grammars.

Use of language models to exploit structured information.

Description

Theoretical and practical study of :

Propositional logic

Predicate logic

Set theory and structural induction

Hoare logic and program proofs

Language theory

Regular expressions

Grammars

Person(s) in charge
PANTEL MARC

· Semestre 6 à l'N7-1A SN-FISE

· Teaching Unit Upgrade

Person(s) in charge
HULL ALEXANDRA

· Subject English

Pre-requisites

None

Objectives

Develop professional communication competencies by completing key written and oral tasks in English.

Targeted skills

1) Design and create an infographic poster in English.

2) Present a team project in a poster session in English.

3) Write a constructive criticism SWOT-type feedback paper in English.

Description

1 semester of 12 interactive, weekly sessions in English.

Number of hours
21 hours

Teaching method
En présence

Teaching language
English

Bibliography

* Krum, R. (2013). *Cool Infographics: Effective Communication with Data Visualization and Design.* Wiley.

* Gallo, C. (2009). *The Presentation Secrets of Steve Jobs.How To Be Insanely Great In Front Of Any Audience.* McGraw-Hill Education.

* Bright, D. (2014). *The Truth Doesn't Have to Hurt: How To Use Criticism To Strengthen Relationships, Improve Performance And Promote Change.* AMACOM.

· Second language

Choice: 1 Among 1 :

· Subject Spanish

· Subject Portuguese

· Subject Chinese

· Subject Italian

· Subject Japonese

· Subject Russian

· Subject German

· Subject French as a Foreign Language

· Subject Sports

· Subject Leadership and management

Pre-requisites

None.

Objectives

Develop key professional competencies to communicate effectively, manage projects and work in international teams.

Targeted skills

1) Explore the concept of civic engagement and professional skills development.

2) Present a team civic engagement project in English in an infographic poster session.

3) Develop a personalized digital portfolio for personal, professional project (PPP) artifacts.

4) Design and create a video pitch to showcase and explain M1 options chosen.

Description

1 semester of 12 weekly sessions aimed to develop students' personal professional projects.

Number of hours
10.5 hours

Teaching method
En présence

Teaching language
French and English

Bibliography

* Chhabra, S. (2018). *Handbook of Research on Civic Engagement and Social Change in Contemporary Society*. Information Science Reference.
* Krum, R. (2013). *Cool infographics: Effective communication with data visualization and design*. John Wiley & Sons.
* Hartnell-Young, E., & Morriss, M. (2006). *Digital portfolios: Powerful tools for promoting professional growth and reflection*. Corwin Press.
* Westfall, C. (2012). *The New Elevator Pitch: The Definitive Guide to Persuasive Communication in the Digital Age*. BookBaby.

· Teaching Unit TELECOMMUNICATIONS

Pre-requisites

Bases on signal processing

Objectives

- To be able to explain the role of the different elements in a communication channel allowing to transmit a digital information.

- To be able to analyze a basic digital transmission channel (modulation/demodulation on a Additive white Gaussian noise channel) in terms of spectral and power efficiencies.

- To be able to implement basic digital transmission channels, to compare and optimize them in terms of spectral and power efficiencies.

Description

The following issues shall be addressed by this teachning unit:

1- Role of the different elements in a communication channel allowing to transmit a digital information.

2- Generation of a signal allowing to transmit a binary information (digital modulation) :

- for a baseband transmission,

- for a transmission on a carrier frequency (ASK, PSK, QAM modulations),

- notion of spectral efficiency.

3- Basic modulation for the transmission channel.

4- Definition of an optimized digital demodulator :

- power efficiency,

- interference between symbols and Nyquist criterion,

- matched filtering.

5- Bit error rate computation.

6- Notion of complex enveloppe and equivalent lowpass channel for transmissions on carrier frequencies.

7- Example of a basic digital transmission channel : DVB-S physical layer.

Number of hours
7 lectures, 4 sessions of exercises, 11 sessions of practical work, 5 sessions of project

Person(s) in charge
THOMAS Nathalie
Nathalie.Thomas@enseeiht.fr
Phone 2236

THOMAS NATHALIE

Teaching method
En présence

Teaching language
French

Bibliography

J. G. Proakis, Digital Communications, Mc Graw Hill Book Cie

· Subject Télécommunications

Pre-requisites

Bases on signal processing

Objectives

- To be able to explain the role of the different elements in a communication channel allowing to transmit a digital information.

- To be able to analyze a basic digital transmission channel (modulation/demodulation on a Additive white Gaussian noise channel) in terms of spectral and power efficiencies.

- To be able to implement basic digital transmission channels, to compare and optimize them in terms of spectral and power efficiencies.

Targeted skills

Understand the role of the differents elements in a communication channel allowing to transmit a digital information.

Being able to implement and optimize the modulator/demodulator of a communication channel allowing to transmit a digital information when the channel is an AWGN (Additive White Gaussian Noise) channel.

Description

1- Role of the different elements in a communication channel allowing to transmit a digital information.

2- Generation of a signal allowing to transmit a binary information (digital modulation) :

- for a baseband transmission,

- for a transmission on a carrier frequency (ASK, PSK, QAM modulations),

- notion of spectral efficiency.

3- Basic modulation for the transmission channel.

4- Definition of an optimized digital demodulator :

- power efficiency,

- interference between symbols and Nyquist criterion,

- matched filtering.

5- Bit error rate computation.

6- Notion of complex enveloppe and equivalent lowpass channel for transmissions on carrier frequencies.

7- Example of a basic digital transmission channel : DVB-S physical layer.

Number of hours
7 lectures, 4 sessions of exercises, 11 sessions of practical work, 5 sessions of project

Person(s) in charge
THOMAS Nathalie
Nathalie.Thomas@enseeiht.fr
Phone 2236

THOMAS NATHALIE

Teaching method
En présence

Teaching language
French

Bibliography

J. G. Proakis, Digital Communications, Mc Graw Hill Book Cie

· Teaching Unit RESEAUX

Objectives

This module offers basics skills on computer networking. At the end of this module, you will know the main challenges that data networks have to overcome as the main solutions (Intenet, wifi and ethernet).

You will be able to deploy a simple network and to supervise it.

Targeted skills

Undestanding of protocol layers,

Knowing the Internet network stack,

Being able to sniff network and decode frames,

IP, TCP, HTTP, DNS, Ethernet and Wifi basics understanding

Deploying and debugging of a simple network

Person(s) in charge
FASSON JULIEN

· Subject Réseaux

Person(s) in charge
FASSON JULIEN

· Teaching Unit CALCUL SCIENTIFIQUE ET ANALYSE DE DONNEES

Person(s) in charge
SIMON EHOUARN

· Subject Calcul Scientifique

Objectives

Understand, know how to evaluate (complexity, efficiency, precision) and use the basic tools of numerical linear algebra.

Targeted skills

Ability to evaluate basic numerical tools for computation and preprocessing of data.

Description

Singular value decomposition, pseudo-inverse of a matrix and applications.

Notions of numerical errors (direct and inverse errors) and conditioning of a matrix.

Dense matrix factorization for solving linear systems: LU, Cholesky, QR.

Iterative algorithms for solving linear systems: relaxation methods (Jacobi, Gauss-Seidel), steepest descent and conjugate gradient.

Algorithms for the search of eigenvalues/vectors : iterated power, Jacobi algorithm.

Person(s) in charge
SIMON EHOUARN

· Subject Analyse des données

Person(s) in charge
CHARVILLAT VINCENT

· Teaching Unit TECHNOLOGIE OBJET

Person(s) in charge
CREGUT XAVIER

· Subject Technologie Objet

Objectives

To learn object-oriented programming using UML and Java languages.

Description

Main concepts of object-oriented programming are taught: modularity (class, object, fields, methods, constructors, visibility, etc.), abstraction (interfaces, inheritance, abstract classes, static and dynamic binding, etc.), genericity, exceptions, collections, design patterns, event programming (through graphical user interface programming), unit tests.

A project is done using the SCRUM method (from « Project Management » module) with team of 5 to 7 students on a topic they choose at the beginning on the project.

Person(s) in charge
CREGUT XAVIER

Bibliography

- B. Eckel, Thinking in Java. Prentice-Hall, 3 ed., 2002.

- J. Gosling, B. Joy, G. Steele, and G. Bracha, The Java Language Specification. Addison-Wesley, 3 ed., Mar. 2005. http://java.sun.com/docs/books/jls/

- B. Meyer, Object-oriented software construction. Prentice Hall, 2 nd ed., 1997.

- M. Fowler, UML 2.0. CampusPress Référence, 2004.

· Teaching Unit ARCHITECTURE ET SYSTEMES

Person(s) in charge
ERMONT JEROME

· Subject Systèmes d'exploitation centralisés

Pre-requisites
* Good knowledge of algorithms and program development.
* Basic knowledge of computer architecture (processor, bus, main and secondary memory, controllers, interrupts, bypasses, execution modes, etc).

Objectives

* Understanding of the architecture and operation of centralized operating systems.
* Basic practice of system programming under Unix

Targeted skills

Those corresponding to the skills needed by a computer engineer with a "system" profile:

* develop simple utilities
* deploy, administer and operate standard system/application configurations

Description
* presentation of the basic principles and mechanisms used in system design
* practical application of system programming on Linux: processes, files, signals, virtual memory...
* use of basic tools: C language, shell, make

Person(s) in charge
MAURAN PHILIPPE

Bibliography

* Abraham Silberschatz, Peter B. Galvin. Greg Gagne : Operating Systems Concepts (10ème édition, 2018). Wiley
* R. et A. Arpaci-Dusseau Operating Systems : three easy pieces, disponible en ligne
* Jean-Marie Rifflet et Jean-Baptiste Younès, Programmation et communication sous UNIX. Dunod
* R. Bryant, D. O'Hallaron, Computer Systems: A Programmer's Perspective. Pearson
* Marshall Kirk McKusick, Keith Bostic, Michael J. Karels, et John S. Quarterman. Conception et Implémentation du Système BSD 4.4. Addison-Wesley

· Subject Architecture des Ordinateurs

Person(s) in charge
BUISSON JEAN CHRISTOPHE

· Subject Langage C

Pre-requisites

Programmation Impérative 1 et 2 competences are required:

#- Algorithmic langage,

#- Program design with succesive raffinements method,#

- Fonctions and procedures,

#- User data types (records, enumeration and arrays),

#- Modules and genericity,

#- Dynamic memory allocation,

#- Dynamic data structures,

#- Abstract data types.

Objectives

Read, understand and write the concepts of imperative programming in C langage.

Targeted skills

- Write functions and procedures in C (parameter passing by value or by address).

- Define modules in C (.h et .c), in a generic manner if possible.

#- Understand compilation and link edition steps ; manipulate make.

#- Allocate dynamic memory and know when to desallocate.#

- Manipulate entries and outputs, files.

Description

This class is divided in two parts:#

- Part 1 : Introduction to C langage (types, constants, control structures, user types, strings, pointers) and concept of functions and procedures in C.

#This part is composed of one CM, one TD ans one TP that take place in semestre 5.

#- Part 2 : Modules, make and dynamic memory allocation in C.#

This part is composed of one CM, one TD ans one TP that take place in semestre 6.

This C langage class isn't evaluated, but is a pre-requisite for the operating systems class of semester 6.

Person(s) in charge
JAFFRES-RUNSER KATIA

· Teaching Unit SOUTIEN-1A SN-Semestre 6

Optional :

· Subject Soutien en Mathématique - Semestre 6-1A SN

Organizational unit

École Nationale Supérieure d'Électrotechnique d'Électronique d'Informatique d'Hydraulique et des Télécommunications

Ingénieur ENSEEIHT Informatique et Télécommunications 2ème année

MORE INFO

ECTS credits : 60

Organization

· Année 2A SN-FISE

· Choix de Parcours - Semestre 7-2A-SN-FISE

Choice: 1 Among 1 :

· Sem 7 SN Parc. Programme Insertion Méthodologique (PIM)

· Choix d'UE Scientifique-SN

Choice: 3 Among 3 :

· Teaching Unit IDM ET INTERGICIELS

Person(s) in charge
OUEDERNI MERIEM

· Subject Intergiciel dirigée par les modules

Person(s) in charge
CREGUT XAVIER

· Subject Intergiciels

Person(s) in charge
OUEDERNI MERIEM

· Subject Introduction aux Applications Web

Person(s) in charge
HAGIMONT DANIEL

· Teaching Unit COMMUNICATIONS NUMERIQUES SUR CANAUX SELECTIFS

Pre-requisites

Bases on telecommunications

Objectives

To be able to define a more complete channel modelization, compared to the one studied druring the first year teaching unit "Bases on Telecommunications".

To be able to implement one of the following techniques to transmit through a time and frequency selective channel:

- Equalization,

- Orthogonal Frequency Division Multiplexing (OFDM),

- Code Division Multiple Access (CDMA).

Targeted skills

Be able to set up a model of the propagation channel to be traversed in order to be able to dimension the physical layer of the transmission system to be implemented.

Be able to set up and size the physical layer of a transmission system to cross a time and frequency selective channel.

Description

This teaching unit presents the telecommunication network physical layer solutions allowing to communicate on time varying and frequency selective channels: equalization, OFDM and CDMA. These solutions are currently used in several telecommunication systems, such as, for example, 3G, 4G, WiFI, ADSL and Digital Terrestrial TV. They rely on channel models described in the first teaching module.

Number of hours
17 lectures, 2 sessions of exercises, 8 sessions of practical work

Person(s) in charge
THOMAS NATHALIE

Teaching method
En présence

Teaching language
French

Bibliography

- John. G. Proakis, Masoud Salehi, « Digital Communications », McGraw-Hill Education, 5th edition (November 6, 2007)

- Sergio Benedetto, Ezio Biglieri, « Principles of digital transmission : with wireless applications », Published in 1999 in New York (N.Y.) by Kluwer Academic/Plenum publishers.

- Raymond Steele, Lajos Hanzo, « Mobile Radio Communications », 2nd Edition, July 1999, Wiley-IEEE Press.

- J. R. Barry, E. A. Lee, and D. G. Messerschmitt, « Digital Communication », 3rd ed., Boston, MA: Kluwer Academic Publishers, 2003.

- B.P. Lathi and Zhi Ding, « Modern Digital and Analog Communication », International 4th ed. New York ; Oxford : Oxford University Press - Oxford series in electrical and computer engineering, 2010.

- Ahmad R. S. Bahai, Burton R. Saltzberg, Mustafa Ergen, « Multi-Carrier Digital Communications: Theory and Applications of OFDM », 2nd ed. New York : Springer, 2004.

- Ramjee Prasad, « OFDM for wireless communications systems », Artech House, 2004.

- Charles E. Cook, Fred. W. Ellersick,. Laurence B. Milstein, and Donald L. Shilling, « Spread Spectrum Communications », Eds. New York, NY: IEEE Press, 1983.

- Don Torrieri, « Principles of Spread-Spectrum Communication Systems », Third Edition,» Springer, 2015.

- Henrik Schulze and Christian Lüders, «Theory and Applications of OFDM and CDMA: Wideband Wireless Communications », John Wiley, January 2006.

· Subject Modélisation de Canal

Objectives

- Defining basic concepts of propagation channel modelling

- Studying main channel models

- Determining relevant parameters

- Classifying channels

- Understanding the main disturbances due to the channel

- Investigating different solutions to overcome these disturbances, in particular diversity techniques, mainly spatial diversity approaches (MIMO).

Description

I. Introduction

II. Large-scale fading (path loss/shadowing)

III. Frequency-flat channels

IV. Frequency-selective channels

V. Parameters and channel characteristics

VI. Diversity principles

VII. Introduction to MIMO techniques

This course is illustrated by practical sessions on cellular planning using ATOLL software, developed by FORSK. These practical sessions are given by an N7 alumni, senior mobile communications Engineer at FORSK.

Person(s) in charge
COULON MARTIAL

Teaching method
En présence

Teaching language
Français

Bibliography

- E. G. Larsson and P. Stoica, Space-Time Block Coding for Wireless Communications, Cambridge University Press, 2008.

- A. Paulraj, R. Nabar and D. Gore, Introduction to Space-Time Wireless Communications, Cambridge University Press, 2008.

- A. Swami, Q. Zhao, Y.M. Hong, L. Tong, Wireless Sensor Networks: Signal Processing And Communications Perspectives, Wiley, 2017.

- E. Dahlman and S. Parkvall, Wireless Sensor Networks: Signal Processing And Communications Perspectives, Academic Press, 2nd edition, 2013.

- J. Proakis and M. Salehi, Digital Communications. New York: McGraw-Hill, 5th ed., 2008.

- T. S. Rappaport, Wireless Communications, Principles and Practice, Second Edition, Prentice Hall PTR, NJ 2014.

- R. Steele and L. Hanzo, Mobile Radio Comunications, Second and Third Generation Cellular and WATM Systems, 2nd ed., John Wiley and Sons, Ltd, New York, 1999.

· Subject Egalisation de Canal

Objectives

The objective of this course is to present detection and estimation methods in the context of frequency selective channels. A particular attention will be given to linear and nonlinear equalization methods with both time-domain or frequency-domain implementation for single-carrier communication systems.

Targeted skills

-To understand the fundamentals of detection and estimation techniques for frequency-selective channel transmissions;

-To be able to derive the discrete baseband equivalent model of a digital communication schemes for a frequency-dispersive channel;

-To know the main methods for detection and equalization;

-To know how to implement a detector and/or equalizer;

-To know how to select the parameters of the different methods to manage the performance/complexity trade-off.

Description

This course presents the methods for detection and estimation over frequency selective channels. The following points will be addressed:

-Modeling frequency selective channels: equivalent discrete baseband channel models, Forney vs Ungerböeck observation model;

-Time domain linear equalization: ZF and MMSE criteria for non-constrained RII filter and RIF;

- Nonlinear equalization: maximum likelihood detection (trellis, Viterbi Algorithm); non-linear filter-based or block-based detection(DFE) ;

- Frequency domain linear equalization : block circular single-carrier waveform; frequency domain equalization (ZF, MMSE); spectral shaping (OFDM precoded SC-OFDM / DFT, EW-SC-OFDM);

The practical lab. sessions are dedicated to the implementation of the algorithms and models seen in this course.

Number of hours
7 courses, 2 Practice Lab courses

Person(s) in charge
POULLIAT CHARLY

Teaching method
En présence

Teaching language
French

Bibliography

[1] B. P. Lathi and Zhi Ding, Modern Digital and Analog Communication Systems, Oxford University Press, 2009.

[2] John Barry, Edward Lee, David Mersserschnitt, Digital Communications, Kluwer Academic Publisher, Third edition.

[3] Andreas F. Molisch, Wireless Communications, 2nd Edition,IEEE Press-Wiley, 2010.

[4] Digital Communications, 4th edition, John G. Proakis, Mc Graw-Hill.

[5] J. Choi, Adaptive and Iterative Signal Processing in Communications, Cambridge University Press, 2006.

[6] Zhi Ding and Ye Li, Blind Equalization and Identification , Marcel Dekker, New York, 2001.

· Subject OFDM/CDMA

Pre-requisites

Bases on telecommunications

Objectives

To be able to implement one of the following techniques to transmit through a time and frequency selective channel:

- Orthogonal Frequency Division Multiplexing (OFDM),

- Code Division Multiple Access (CDMA).

Description

This teaching introduces Orthogonal Frequency Division Multiplexing (OFDM) and Code Division Multiple Access (CDMA), two techniques allowing to transmit on a frequency selective channel and widely used in several communication standards (for 3G, 4G, WiFI, l'ADSL, DTTV...).

Number of hours
6 lectures, 4h of practical work

Person(s) in charge
THOMAS Nathalie
Nathalie.Thomas@enseeiht.fr
Phone 2236

THOMAS NATHALIE

Teaching method
En présence

Teaching language
French

Bibliography

- Ahmad R. S. Bahai, Burton R. Saltzberg, Mustafa Ergen, « Multi-Carrier Digital Communications: Theory and Applications of OFDM », 2nd ed. New York : Springer, 2004.

- Ramjee Prasad, « OFDM for wireless communications systems », Artech House, 2004.

- Charles E. Cook, Fred. W. Ellersick,. Laurence B. Milstein, and Donald L.Shilling, « Spread Spectrum Communications », Eds. New York, NY: IEEE Press, 1983.

- Don Torrieri, « Principles of Spread-Spectrum Communication Systems »,Third Edition,» Springer, 2015.

- Henrik Schulze and Christian Lüders, «Theory and Applications of OFDM and CDMA: Wideband Wireless Communications », John Wiley, January 2006.

· Teaching Unit COMMUNICATION NUMERIQUES CODEES

Pre-requisites

Digital communications (UE N6EN02 "Telecommunications" or equivalent)

Objectives

- be able to dimension a channel coding scheme based on convolutional and cycle codes

- be able to code and decode the proposed codes

- understand the issues of time-frequency-phase synchronization and channel estimation in a receiver

- understand the problematic of data compression

- be able to implement a mobile communications chain and evaluate its performance on MATLAB software

Targeted skills

- be able to define a coding scheme based on convolutional and cyclic codes for the physical layer of a telecommunications system (fixed/mobile, single/multi-carrier)

-be able to model and analyze the communication chain obtained using MATLAB software

- understand the issues of time-frequency-phase synchronization and channel estimation in a receiver

Description

The first part of this unit is devoted to channel coding, and more specifically to the study of convolutional and cyclic codes.

This first part is followed by an introduction to digital receivers and data compression.

The last part of the EU is devoted to the sizing and implementation under MATLAB of a communications chain encoded on a frequency-selective channel.

Number of hours
64

Person(s) in charge
BOUCHERET Marie-laure
Marie-Laure.Boucheret@enseeiht.fr
Phone 2229

MAILHES Corinne
Corinne.Mailhes@enseeiht.fr
Phone 2237

BOUCHERET MARIE LAURE

Teaching method
En présence

Teaching language
French

Bibliography

• « Digital communications », John Proakis, McGraw-Hill Higher Education

• « Channel Codes: Classical and Modern», William Ryan et Shu Lin, Cambridge University Press

· Subject Codage canal

Pre-requisites

Digital communications (UE N6EN02 "Telecommunications" or equivalent)

Objectives

- be able to dimension a channel coding scheme based on convolutional and cyclic codes

- be able to encode and decode the proposed codes

Targeted skills

- be able to define a coding scheme based on convolutional and cyclic codes for the physical layer of a telecommunications system (fixed/mobile, single/multi-carrier)

Description

This module is dedicated to channel coding, and more specifically to the study of convolutional and cyclic codes:

- convolutional codes: state diagram, Viterbi algorithm, punching

- cyclic codes: Galois body, binary BCH codes, Reed-Solomon codes

- concatenated codes

Person(s) in charge
BOUCHERET Marie-laure
Marie-Laure.Boucheret@enseeiht.fr
Phone 2229

BOUCHERET MARIE LAURE

Teaching method
En présence

Teaching language
French

Bibliography

« Channel Codes: Classical and Modern», William Ryan et Shu Lin, Cambridge University Press

· Subject Récepteurs

Pre-requisites

Digital communications (UE N6EN02 "Telecommunications" or equivalent)

Objectives

- understand the issues of time-frequency-phase synchronization and channel estimation in a receiver

- understand the block diagram of a receiver

Targeted skills

- understand the issues of time-frequency-phase synchronization and channel estimation in a receiver

- understand the block diagram of a receiver

Description

This section is devoted to an introduction to digital receivers :

- need for time-frequency synchronization (+ phase in the Gaussian channel) and channel estimation

- block diagram of a satellite receiver

- channel estimation (single and multi-carrier)

Person(s) in charge
BOUCHERET Marie-laure
Marie-Laure.Boucheret@enseeiht.fr
Phone 2229

BOUCHERET MARIE LAURE

Teaching method
En présence

Teaching language
French

· Subject Source Coding

Pre-requisites

Probabilities. Matrix computation

Objectives

Understand what is source coding: lossless or lossy coding methods: lossless linked to information theory and lossy methods based on signal processing, with the 2 big families, predictive coding and transform coding.

Targeted skills

Be able to ask the good questions for source coding: with or without distorsion? And with distorsion, which family of methods?

Description

I. Introduction

II. Lossless coding : basis (information theory in short), Huffman coding, based-dictionary methods, arithmetic coding

III. Lossy coding: the importance of scalar quantization

IV. Lossy coding: predictive coding

V. Lossy coding: transform coding

Number of hours
3 CM de 1h45 + 2 TD de 1h45

Person(s) in charge
MAILHES Corinne
Corinne.Mailhes@enseeiht.fr
Phone 2237

MAILHES CORINNE

Teaching method
En présence

· Subject Projet

Pre-requisites

N7EN02 Digital communications on selective channels

N7EN03A Channel coding

Objectives

- be able to dimension a communication chain on a selective channel (fixed/mobile) according to specifications

- be able to implement this communication chain

- be able to evaluate its performance using MATLAB software

Targeted skills

-be able to design and analyze a communication chain on a selective channel using MATLAB software

Description

This module is dedicated to the dimensioning and implementation using MATLAB of a coded communication chain on a frequency-selective channel. The performance of the chain will also be evaluated.

Person(s) in charge
BOUCHERET MARIE LAURE

Teaching method
En présence

Teaching language
French

· Teaching Unit RESEAUX LOCAUX ET DE TELECOMMUNICATIONS

Description

This teaching unit is dedicated to Local Area Networks and Telecom Networks:

- in the context of Local Area Networks, we mainly focus on Ethernet architecture and its evolution. The second part is dedicated to bridging.

- in the context of Telecom Networks, we will present the different solutions for circuit and packet switching networks.

The main objectives of this course are to understand the principles, the architecture and the protocols of these networks.

Person(s) in charge
BEYLOT ANDRE LUC

Bibliography

Les Réseaux, Guy Pujolle, Eyrolles, Edition 2018

Réseaux Locaux et Internet, Laurent Toutain, Hermès

· Subject Réseaux Locaux

Objectives

At the end of the course, students will be able to recognize the specificities of a local area network, to explain the operation of a local area network architecture, to produce configurations for Ethernet devices, to differentiate between WiFi technologies

Description

1-IEEE architecture and standardization - MAC addressing - concept of bridging - LLC frame exchange and services

2- Ethernet- Segmentation and Virtualization -Frame format- Architectures with and without LLC- Ethernet segmentation: VLANs- InterVLAN communication by router- CoS class of services- Virtual bridging

3- Bridged network: Principle of redundancy - Spaning tree algorithms - STP and RSTP protocols - VLAN and spaning trees - other routings

4- Ethernet link - Bit rate and transmission support - Flow control - Autonegociation - Aggregation - Energy saving

5- WiFi - 802.11 Transmissions and Architectures - Basic MAC access control mechanisms: CSMA / CA and polling – Advanced mechanisms: energy saving and quality of service, multimedia WiFi

Person(s) in charge
PAILLASSA BEATRICE

Teaching language
Francais

· Subject Réseaux de Télécommunications

Pre-requisites

Knowledge of the principles of network operation

Objectives

This subject allows to describe the functioning of telecommunication networks and their specificities in terms of architectures, signaling...

For these different architectures, the main associated protocols will be described.

Targeted skills

Understanding of the functioning of telecommunication networks.

Mastery of the main telecom network architectures.

Person(s) in charge
BEYLOT ANDRE LUC

Bibliography

Les Réseaux, Guy Pujolle, Eyrolles, 2018

· Teaching Unit ARCHITECTURE DES ORDINATEURS

Objectives

VHDL will be presented through exemples of components. We will study its specific features (signals, parallel execution). Examples with increasing complexity will be considered, up to the design of the components of a computer (mini-processor, UART, memory hierarchy, ...). These components will be emulated on an FPGA. A project will consider a more complex example. In a second part, we will summarize the evolution towards multiprocessor architecture

Person(s) in charge
SCHARBARG JEAN LUC

Bibliography

• Architecture des Ordinateurs : une approche quantitative (J.L. Hennessy et D.A. Patterson - Thomson Publishing)

• VHDL - langage, modélisation, synthèse(R. AIRIAU et al. - Presses Polytechniques et Universitaires Romandes)

· Subject Architecture des Ordinateurs

Person(s) in charge
SCHARBARG JEAN LUC

· Teaching Unit BASE DE LA PROGRAMMATION FONCT ET TRADUCTION DES LANGAGES

Objectives

The objective of the UE is twofold. The student must master the principles of algorithmic and without side effect programming using functional programming. In particular, he must master the concepts of recursion, complexity and termination of the algorithms. It must be able to handle lists and iterators, as well as modules and functors. The associated programming language is the OCaml language.

He must also master the different stages of language translation: lexical analysis, syntaxic analysis and semantic analysis. In the particular case of compilation, he must know four phases of the semantic analysis: the resolution of the identifiers thanks to a table of symbols, the typing, the memory placement of the variables and the code generation. The student will create a compiler that will take a sub-part of C into input language, which will produce code for an abstract stack machine. The compiler will itself be written in OCaml.

Person(s) in charge
HURAULT AURELIE

Bibliography

• OCaml from the very beginning, John Whitington, 2013

• Développement d’applications avec Objective Caml, Emmanuel Chailloux, Pascal Manoury, Bruno Pagano

• Purely Functional Data Structures, Chris Okasaki, 1999

• Compilers: Principles, Techniques, and Tools (dragon book), Alfred V. Aho, Monica S. Lam, Ravi Sethi, and Jeffrey D. Ullman,, 2007

· Subject Programmation Fonctionnelle

Objectives

The student should master the principles of algorithms and programming without side effects using functional programming. He must in particular master the concepts of recursion, complexity and termination of algorithms. He must be able to handle lists and iterators, as well as modules and functors. The practical part is done using the OCaml programming language.

Person(s) in charge
HURAULT AURELIE

· Subject Traduction des Langages

Objectives

The student must master the different stages of language translation: lexical analysis, syntactic analysis and semantic analysis.

In the particular case of compilation, he must know four phases of semantic analysis: resolution of identifiers using a symbol table, typing, memory placement of variables and code generation. The student will realize a compiler that will take in input language a sub-part of C, which will produce code for an abstract stack machine. The compiler itself will be

written in OCaml.

Person(s) in charge
HURAULT AURELIE

· Subject PF et TDL

Objectives

The goal of the Functional Programming and Language Translation project is to extend the compiler made in language translation practical work to handle new constructions (e.g. pointers, arrays, named types, "for" loops, prototypes,...).

The compiler will be written in OCaml and will have to respect the principles of functional programming studied during the courses, tutorials and practical work of functional programming.

Person(s) in charge
HURAULT AURELIE

· Teaching Unit SYSTEMES CONCURRENTS ET COMMUNICANTS

Description

Presentation of basic concepts, principles and mechanisms in concurrent programming and middleware. More precisely:

* modelling and design of parallel systems

* reasoning and evaluation on concurrent programs

* essential design and synchronization patterns

* practice of coarse-grained concurrent programming

* understanding and knowledge of distributed interaction models

* design and programming of applications according to the distributed object model

Person(s) in charge
MAURAN PHILIPPE

Bibliography

* Maurice Herlihy and Nir Shavit : The Art of Multiprocessor Programming, Morgan Kaufmann, 2012

* M. Raynal Concurrent Programming : Algorithms, Principles, and Foundations, Springer 2013

* Fred B. Schneider : On Concurrent Programming, Springer, 1997

* George Coulouris, Jean Dollimore, Tim Kindberg and Gordon Blair : Distributed Systems - Concepts and Design, Addison Wesley 2011

· Subject Systèmes Concurrents

Pre-requisites

Basics of centralized operating systems

Programming in Java language

Objectives

Presentation of the basic concepts, principles and mechanisms of concurrent programming

Targeted skills

design and develop concurrent applications

understand and control the dynamics of a concurrent system

Description

modeling and design of parallel systems

reasoning and evaluation of concurrent applications

essential design and synchronization patterns

practice of coarse-grained concurrent programming

Person(s) in charge
MAURAN PHILIPPE

· Subject Intergiciels

Objectives

Present the principles and basic technologies in the area of middleware, allowing the construction of distributed applications

Description

- the socket interface

- the client-server model and remote invocation tools (RPC, RMI, web services)

- message oriented middleware (JMS)

- application integration (ESB)

Person(s) in charge
HAGIMONT DANIEL

· Subject Projet Données Réparties

Pre-requisites

- concurrent systems

- middlewares

Objectives

- Put into practice the concepts presented in Middlewares and Concurrent Systems

- Manage a project in a group

Description

The project focuses on the creation of a platform to manage concurrent applications operating on shared data, in a centralized and then distributed environment.

It will consist in developing the platform itself, then evaluating it through the development of a panel of applications using this platform.

The requested platform includes, in a simplified way, the functionalities of standard software in the domain. For example, the latest editions of the project are based on the architecture of the Hadoop platform.

Person(s) in charge
MAURAN PHILIPPE

· Teaching Unit THEORIE DES AUTOMATES ET DES LANGAGES, THEORIE DES GRAPHES

Objectives

The objective of the UE is twofold. The student must master the formalisms of finite automata, stack automata and Turing machine for the modeling of state based systems and the implementation of lexical and syntactic analyses. He is also introduced to the computability and complexity theories.

The student must also master the principal concepts and results of Graph Theory and is able to apply them to real life problems and situations. He can implement and test classical algorithms of graph theory, such as Euler's circuit, Disjkstra's shortest path, Welsh-Powell's coloring, etc.

Person(s) in charge
MORIN GÉRALDINE

Bibliography

• Olivier Carton, Langages formels, calculabilité et complexité, Vuibert, 2008 (ISBN 978-2-7117-2077-4)

• Hopcroft, John E.; Motwani, Rajeev; Ullman, Jeffrey D. (2013). Introduction to Automata Theory, Languages, and Computation(3rd ed.). Pearson. ISBN 1292039051.

• Ferdinand Wagner, Ruedi Schmuki, Thomas Wagner et Peter Wolstenholme, Modeling Software with Finite State Machines : A Practical Approach, Auerbach Publications, 2006, 392 p. (ISBN 9780849380860).

* Gondran, Michel, and Michel Minoux. Graphs and algorithms. Wiley, 1984

· Subject Automates

Pre-requisites

Language theory (see the Modelling subject of the Modelling and Programming UE)

Objectives

To discover, understand and know how to exploit the mathematical tools necessary for the formal modeling of the dynamics of discrete systems and for the analysis of structured information: finite automata, stack automata and Turing

machines. The subject covers both theoretical and practical aspects through the use of state-of-the-art tools for modeling discrete systems, and the use of formal description languages for the exploitation of structured information.

Targeted skills

Modeling the dynamics of discrete systems using finite automata.

Construction of structured information analysis tools from language models in the form of regular expressions and grammars.

Description

Theoretical and practical study of :

Finite automata

Stacked automata

Structured information analysis techniques

Recursive top-down analysis

Generators of lexical and syntactic parsers

Person(s) in charge
PANTEL MARC

· Subject Graphes

Pre-requisites

Programming skills in ocaml

Objectives

The student must master the principal concepts and results of Graph Theory and is able to apply them to real life problems and situations. He can implement and test classical algorithms of graph theory, such as Euler's circuit, Disjkstra's shortest path, Welsh-Powell's coloring, etc.

Description

Chapter 1 : Definitions and basic concepts

Chapter 2 : Graph connexity

Chapter 3 : Euler and Hamilton graphs

Chapter 4 : Exploring graphs

Chapter 5 : Graph coloring and Planar graphs

Each chapter is studied in class and related exercices are proposed.

5 labs are dedicated to the project.

Number of hours
5 cours-TD, 5 TP

Person(s) in charge
MORIN GÉRALDINE

Bibliography

* Gondran, Michel, and Michel Minoux. Graphs and algorithms. Wiley, 1984

· Teaching Unit GENIE DU LOGICIEL ET DES SYSTEMES

Objectives

Study of the main software engineering principles. Understand and implement design patterns and model driven engineering.

Person(s) in charge
CREGUT XAVIER

Bibliography

• Gamma, Erich; Richard Helm, Ralph Johnson, and John Vlissides (1995). Design Patterns : Elements of Reusable Object-Oriented Software. Addison-Wesley. ISBN 0-201-63361-2.

• Mark Grand. Patterns in Java: A Catalog of Reusable Design Patterns Illustrated with UML, volume 1. Wiley, 2 edition, 2002.

• Sommerville, Ian (2007) [1982]. Software Engineering (8th ed.). Harlow,England : Pearson Education. ISBN 0-321-31379-8

• Model-Driven Software Development : Technology, Engineering, Management (Wiley Software Patterns Series) Thomas Stahl, Markus Voelter, ISBN0-470-02570-0.

• EMF: Eclipse Modeling Framework 2.0 2nd, David Steinberg, Frank Budinsky, Marcelo Paternostro, Ed Merks, Addison-Wesley Professional, 2009 ISBN : 0321331885.

· Subject Génie du Logiciel et des Systèmes

Objectives

Study of the main software engineering principles. Understand and implement design patterns and model driven engineering.

Description

The first part presents main principles of Model-Driven Engineering (MDE): metamodelling (EMF), static semantics (OCL), textual (Xtext) or graphical (Sirius) concrete syntaxes, model to text transformations (Acceleo), model to model transformations (EMF/Java and ATL). A running example is used to illustrate all these concepts and tools.

The second part deals with design patterns, reflection, annotations and test.

Person(s) in charge
CREGUT XAVIER

Bibliography

- Gamma, Erich; Richard Helm, Ralph Johnson, and John Vlissides (1995). Design Patterns : Elements of Reusable Object-Oriented Software. Addison-Wesley. ISBN 0-201-63361-2.

- Mark Grand. Patterns in Java: A Catalog of Reusable Design Patterns Illustrated with UML, volume 1. Wiley, 2 edition, 2002.

- Sommerville, Ian (2007) [1982]. Software Engineering (8th ed.). Harlow, England : Pearson Education. ISBN 0-321-31379-8

- Model-Driven Software Development : Technology, Engineering, Management (Wiley Software Patterns Series) Thomas Stahl, Markus Voelter, ISBN

0-470-02570-0.

- EMF: Eclipse Modeling Framework 2.0 2nd, David Steinberg, Frank Budinsky, Marcelo Paternostro, Ed Merks, Addison-Wesley Professional, 2009 ISBN:0321331885.

· Teaching Unit OPTIMISATION ET R.O.

Description

Students will have the opportunity to become thoroughly familiar with all the results presented in the course of tutorials, in which modeling issues and optimality conditions will be addressed on the basis of various practical optimization problems. A significant amount of practical work will also allow students to implement numerical methods (Newton, Gauss-Newton) and to test them for the treatment of nonlinear least squares problems, as well as on more general optimization problems with constraints.

Databases tend to use simplistic models (entity association, relational) and languages (relational calculus and algebra, SQL). This does not make the representation of a more complex universe so easy; but it allows us to highlight the problems related to the computer storage of files (coherence, confidentiality, etc., and especially redundancy) via the theory of normalization: functional and multi-valued dependencies, Boyce-Codd normal form, third and fourth normal form, etc. Essentially theoretical, this study will conclude, in practical work, with a brief presentation of the main technical tools for files: hash tables and indexes.

Person(s) in charge
RUIZ DANIEL

Bibliography

F.S. Hillier, G.J. Liebermann Operations Research - Mc Graw Hill, Eigth Edition, 2005

Dominique de Werra, Thomas M. Liebling et Jean-Franc#ois He#che. Recherche ope#rationnelle pour inge#nieurs - Presses polytechniques et universitaires romandes. 2003.

· Subject Optimisation

Pre-requisites

First year optimization course

Objectives

The objective of this module is to introduce the theoretical mathematical tools to characterize the local and/or global minima (or maxima) of a real-valued function, with the possible consideration of constraints on the state space.

From these general theoretical aspects, we will develop various algorithms for numerical optimization, and we will study their properties such as global convergence, convergence speed, etc. From a practical point of view, these algorithms will be implemented in the framework of practical work on computers, and tested on various particular problems.

Description

Following the results of the first year course, which gave the necessary/sufficient conditions characterizing the solutions of unconstrained optimization problems, we develop the Karush-Kuhn-Tucker-Lagrange conditions related to the characterization of the optima of a constrained function. These theoretical results are based on particular geometric concepts, such as the cone of admissible directions at a point in the constraint domain. We will analyze these geometrical aspects in detail in the construction of these mathematical results.

As for numerical methods for optimization, we will detail two types of algorithms, one for unconstrained problems, and the other with constraints. In both cases, we will study the convergence of these algorithms and we will focus on some practical aspects such as the choice of relevant stopping criteria, the scaling of the problem variables ...

The students will have the opportunity to familiarize themselves in depth with all the results presented in the framework of tutorial sessions, in which modeling issues and optimality conditions will be addressed on the basis of various practical optimization problems.

A significant amount of practical work will also allow students to implement numerical methods (confidence regions, augmented Lagrangian, etc.) and to test them for the treatment of optimization problems with constraints.

Person(s) in charge
RUIZ DANIEL

Bibliography

Jorge Nocedal and Stephen Wright, Numerical Optimization, Springer, 2006

· Subject Recherche Opérationnelle

Pre-requisites

Basic knowledge of linear algebra, differential calculus, probability theory and programming.

Objectives

Provide the mathematical basis for modeling and solving operations research problems.

Targeted skills

To be able to model and solve Operational Research problems.

Description

The course describes the main methods for modeling and solving Operations Research problems whose objective is decision support. Five projects are proposed to the students who must program in Matlab their solution programs. The course examines in turn linear and integer programming methods (simplex algorithm), maximal flow and tension methods (Ford and Fulkerson algebra), non-zero sum game theory in a non-cooperative game context, Markov chains and trajectory planning in mobile robotics.

Person(s) in charge
MARTHON PHILIPPE

Bibliography

Dominique de Werra, Thomas M. Liebling et Jean-François Hêche. Recherche opérationnelle pour ingénieurs - Presses polytechniques et universitaires romandes. 2003.

· Teaching Unit PROGRAMMATION FONCTIONNELLE

Objectives

The objective of the UE is to master the principles of algorithmic and side effect free functional programming. In particular, he must master the concepts of recursion, complexity and termination of the algorithms. He can handle lists, tree-like data structures and their iterators, but also lazy structures such as streams. He can design and give structure to applications through the use of modules, functors and advanced typing schemes. The associated programming language is the OCaml language.

Person(s) in charge
THIRIOUX XAVIER

Bibliography

• OCaml from the very beginning, John Whitington, 2013

• Développement d’applications avec Objective Caml, Emmanuel Chailloux, Pascal Manoury, Bruno Pagano

• Purely Functional Data Structures, Chris Okasaki, 1999

· Subject Programmation Fonctionnelle

Description

Please refer to the UE syllabus, as this is the sole topic in the UE.

Person(s) in charge
THIRIOUX XAVIER

· Teaching Unit INTERNET ET GRAPHES

Person(s) in charge
FASSON JULIEN

· Subject Internet

Pre-requisites

Basics of communication networks

Objectives

Understand the main technical issues of a network such as the Internet

Analyze the technical solutions proposed by the IP architecture

Understand routing, congestion control, address translation, interconnection, ...

Description

Routing (RIP, OSPF),

congestion control (TCP variants),

address translation,

interconnection (tunneling techniques), ...

Person(s) in charge
CHAPUT EMMANUEL

· Subject Projet Interconnexion

Person(s) in charge
FASSON JULIEN

· Subject Théorie des graphes

Objectives

To discover basic concepts and methods of graph theory from a family of practical problems. At the end of the lecture, the student must discover ten important problems and appropriate algorithms.

Description

- Basic objects
- Shortest path: Moore-Dijkstra and Ford algorithms.
- Scheduling: PER analysis
- Hamiltonian paths: Demoucron and Kaufman methods - Malgrange
- Eulerian paths
- Maximum flows: Ford-Fulkerson algorithm
- Optimal assignments: Hungarian method
- Properties relating to cycles, trees , Spanning trees with optimal weight: Kruskal's algorithm
- Graph coloring, planar graphs: Euler's formula.

Person(s) in charge
DHAOU RIADH

Bibliography

Graphs and hypergraphs - Author: Claude Berge - Publisher: Dunod, 1975

Graphs and Algorithms - Author: Michel Gondran and Michel Minoux - Editor: Eyrolles, 1980

· Teaching Unit SOFT AND HUMAN SKILLS

Person(s) in charge
HULL ALEXANDRA

· Subject Professional English 2.1 : Presentations

Pre-requisites

None.

Objectives

Perform key oral and written workplace tasks in English.

Targeted skills

1) Deliver an effective scientific or technical presentation in English.

2) Develop your professional network; contact and interview an alumni (in English preferably).

3) Write a report of the alumni interview in English; prepare written documents in English (CV, letter, PowerPoint) for your Personal Professional Project (PPP).

Description

A semester of 12 interactive weekly sessions to develop English intercultural communication competencies for professional purposes.

Number of hours
21 hours

Teaching method
En présence

Teaching language
English

Bibliography
* Gallo, C. (2014). *Talk Like TED: The 9 Public-speaking Secrets of the World's Top Minds.* St. Martin's Press.

* Treu, J. (2014). *Social Wealth: How to Build Extraordinary Relationships By Transforming the Way We Live, Love, Lead and Network.* Be Extraordinary LLC.

* Garner, B. A. (2013). *HBR Guide to Better Business Writing (HBR Guide Series).* Harvard Business Review Press.

· 2nd language

Choice: 1 Among 1 :

· Subject Spanish

· Subject Spanish

· Subject Chinese

· Subject Italian

· Subject Japanese

· Subject Russian

· Subject German

· Subject French as a Foreign Language

· Subject Sports

· Subject Leadership & Management

Person(s) in charge
HULL ALEXANDRA

· Teaching Unit FRANCAIS LANGUE ETRANGERE (FLE (PIM)

· Teaching Unit PROJET FLE (PIM)

· Semestre 7 CESURE

· Semestre 7 SN FISE Parcours Architecture Système et Réseaux

Person(s) in charge
JAKLLARI GENTIAN

· Teaching Unit SOFT AND HUMAN SKILLS

Person(s) in charge
HULL ALEXANDRA

· Subject Professional English 2.1 : Presentations

Pre-requisites

None.

Objectives

Perform key oral and written workplace tasks in English.

Targeted skills

1) Deliver an effective scientific or technical presentation in English.

2) Develop your professional network; contact and interview an alumni (in English preferably).

3) Write a report of the alumni interview in English; prepare written documents in English (CV, letter, PowerPoint) for your Personal Professional Project (PPP).

Description

A semester of 12 interactive weekly sessions to develop English intercultural communication competencies for professional purposes.

Number of hours
21 hours

Teaching method
En présence

Teaching language
English

Bibliography
* Gallo, C. (2014). *Talk Like TED: The 9 Public-speaking Secrets of the World's Top Minds.* St. Martin's Press.

* Treu, J. (2014). *Social Wealth: How to Build Extraordinary Relationships By Transforming the Way We Live, Love, Lead and Network.* Be Extraordinary LLC.

* Garner, B. A. (2013). *HBR Guide to Better Business Writing (HBR Guide Series).* Harvard Business Review Press.

· 2nd language

Choice: 1 Among 1 :

· Subject Spanish

· Subject Spanish

· Subject Chinese

· Subject Italian

· Subject Japanese

· Subject Russian

· Subject German

· Subject French as a Foreign Language

· Subject Sports

· Subject Leadership & Management

Person(s) in charge
HULL ALEXANDRA

· Teaching Unit RESEAUX LOCAUX ET DE TELECOMMUNICATIONS

Description

This teaching unit is dedicated to Local Area Networks and Telecom Networks:

- in the context of Local Area Networks, we mainly focus on Ethernet architecture and its evolution. The second part is dedicated to bridging.

- in the context of Telecom Networks, we will present the different solutions for circuit and packet switching networks.

The main objectives of this course are to understand the principles, the architecture and the protocols of these networks.

Person(s) in charge
BEYLOT ANDRE LUC

Bibliography

Les Réseaux, Guy Pujolle, Eyrolles, Edition 2018

Réseaux Locaux et Internet, Laurent Toutain, Hermès

· Subject Réseaux Locaux

Objectives

At the end of the course, students will be able to recognize the specificities of a local area network, to explain the operation of a local area network architecture, to produce configurations for Ethernet devices, to differentiate between WiFi technologies

Description

1-IEEE architecture and standardization - MAC addressing - concept of bridging - LLC frame exchange and services

2- Ethernet- Segmentation and Virtualization -Frame format- Architectures with and without LLC- Ethernet segmentation: VLANs- InterVLAN communication by router- CoS class of services- Virtual bridging

3- Bridged network: Principle of redundancy - Spaning tree algorithms - STP and RSTP protocols - VLAN and spaning trees - other routings

4- Ethernet link - Bit rate and transmission support - Flow control - Autonegociation - Aggregation - Energy saving

5- WiFi - 802.11 Transmissions and Architectures - Basic MAC access control mechanisms: CSMA / CA and polling – Advanced mechanisms: energy saving and quality of service, multimedia WiFi

Person(s) in charge
PAILLASSA BEATRICE

Teaching language
Francais

· Subject Réseaux de Télécommunications

Pre-requisites

Knowledge of the principles of network operation

Objectives

This subject allows to describe the functioning of telecommunication networks and their specificities in terms of architectures, signaling...

For these different architectures, the main associated protocols will be described.

Targeted skills

Understanding of the functioning of telecommunication networks.

Mastery of the main telecom network architectures.

Person(s) in charge
BEYLOT ANDRE LUC

Bibliography

Les Réseaux, Guy Pujolle, Eyrolles, 2018

· Teaching Unit ARCHITECTURE DES ORDINATEURS

Objectives

VHDL will be presented through exemples of components. We will study its specific features (signals, parallel execution). Examples with increasing complexity will be considered, up to the design of the components of a computer (mini-processor, UART, memory hierarchy, ...). These components will be emulated on an FPGA. A project will consider a more complex example. In a second part, we will summarize the evolution towards multiprocessor architecture

Person(s) in charge
SCHARBARG JEAN LUC

Bibliography

• Architecture des Ordinateurs : une approche quantitative (J.L. Hennessy et D.A. Patterson - Thomson Publishing)

• VHDL - langage, modélisation, synthèse(R. AIRIAU et al. - Presses Polytechniques et Universitaires Romandes)

· Subject Architecture des Ordinateurs

Person(s) in charge
SCHARBARG JEAN LUC

· Teaching Unit BASE DE LA PROGRAMMATION FONCT ET TRADUCTION DES LANGAGES

Objectives

The objective of the UE is twofold. The student must master the principles of algorithmic and without side effect programming using functional programming. In particular, he must master the concepts of recursion, complexity and termination of the algorithms. It must be able to handle lists and iterators, as well as modules and functors. The associated programming language is the OCaml language.

He must also master the different stages of language translation: lexical analysis, syntaxic analysis and semantic analysis. In the particular case of compilation, he must know four phases of the semantic analysis: the resolution of the identifiers thanks to a table of symbols, the typing, the memory placement of the variables and the code generation. The student will create a compiler that will take a sub-part of C into input language, which will produce code for an abstract stack machine. The compiler will itself be written in OCaml.

Person(s) in charge
HURAULT AURELIE

Bibliography

• OCaml from the very beginning, John Whitington, 2013

• Développement d’applications avec Objective Caml, Emmanuel Chailloux, Pascal Manoury, Bruno Pagano

• Purely Functional Data Structures, Chris Okasaki, 1999

• Compilers: Principles, Techniques, and Tools (dragon book), Alfred V. Aho, Monica S. Lam, Ravi Sethi, and Jeffrey D. Ullman,, 2007

· Subject Programmation Fonctionnelle

Objectives

The student should master the principles of algorithms and programming without side effects using functional programming. He must in particular master the concepts of recursion, complexity and termination of algorithms. He must be able to handle lists and iterators, as well as modules and functors. The practical part is done using the OCaml programming language.

Person(s) in charge
HURAULT AURELIE

· Subject Traduction des Langages

Objectives

The student must master the different stages of language translation: lexical analysis, syntactic analysis and semantic analysis.

In the particular case of compilation, he must know four phases of semantic analysis: resolution of identifiers using a symbol table, typing, memory placement of variables and code generation. The student will realize a compiler that will take in input language a sub-part of C, which will produce code for an abstract stack machine. The compiler itself will be

written in OCaml.

Person(s) in charge
HURAULT AURELIE

· Subject PF et TDL

Objectives

The goal of the Functional Programming and Language Translation project is to extend the compiler made in language translation practical work to handle new constructions (e.g. pointers, arrays, named types, "for" loops, prototypes,...).

The compiler will be written in OCaml and will have to respect the principles of functional programming studied during the courses, tutorials and practical work of functional programming.

Person(s) in charge
HURAULT AURELIE

· Teaching Unit SYSTEMES CONCURRENTS ET COMMUNICANTS

Description

Presentation of basic concepts, principles and mechanisms in concurrent programming and middleware. More precisely:

* modelling and design of parallel systems

* reasoning and evaluation on concurrent programs

* essential design and synchronization patterns

* practice of coarse-grained concurrent programming

* understanding and knowledge of distributed interaction models

* design and programming of applications according to the distributed object model

Person(s) in charge
MAURAN PHILIPPE

Bibliography

* Maurice Herlihy and Nir Shavit : The Art of Multiprocessor Programming, Morgan Kaufmann, 2012

* M. Raynal Concurrent Programming : Algorithms, Principles, and Foundations, Springer 2013

* Fred B. Schneider : On Concurrent Programming, Springer, 1997

* George Coulouris, Jean Dollimore, Tim Kindberg and Gordon Blair : Distributed Systems - Concepts and Design, Addison Wesley 2011

· Subject Systèmes Concurrents

Pre-requisites

Basics of centralized operating systems

Programming in Java language

Objectives

Presentation of the basic concepts, principles and mechanisms of concurrent programming

Targeted skills

design and develop concurrent applications

understand and control the dynamics of a concurrent system

Description

modeling and design of parallel systems

reasoning and evaluation of concurrent applications

essential design and synchronization patterns

practice of coarse-grained concurrent programming

Person(s) in charge
MAURAN PHILIPPE

· Subject Intergiciels

Objectives

Present the principles and basic technologies in the area of middleware, allowing the construction of distributed applications

Description

- the socket interface

- the client-server model and remote invocation tools (RPC, RMI, web services)

- message oriented middleware (JMS)

- application integration (ESB)

Person(s) in charge
HAGIMONT DANIEL

· Subject Projet Données Réparties

Pre-requisites

- concurrent systems

- middlewares

Objectives

- Put into practice the concepts presented in Middlewares and Concurrent Systems

- Manage a project in a group

Description

The project focuses on the creation of a platform to manage concurrent applications operating on shared data, in a centralized and then distributed environment.

It will consist in developing the platform itself, then evaluating it through the development of a panel of applications using this platform.

The requested platform includes, in a simplified way, the functionalities of standard software in the domain. For example, the latest editions of the project are based on the architecture of the Hadoop platform.

Person(s) in charge
MAURAN PHILIPPE

· Teaching Unit INTERNET ET GRAPHES

Person(s) in charge
FASSON JULIEN

· Subject Internet

Pre-requisites

Basics of communication networks

Objectives

Understand the main technical issues of a network such as the Internet

Analyze the technical solutions proposed by the IP architecture

Understand routing, congestion control, address translation, interconnection, ...

Description

Routing (RIP, OSPF),

congestion control (TCP variants),

address translation,

interconnection (tunneling techniques), ...

Person(s) in charge
CHAPUT EMMANUEL

· Subject Projet Interconnexion

Person(s) in charge
FASSON JULIEN

· Subject Théorie des graphes

Objectives

To discover basic concepts and methods of graph theory from a family of practical problems. At the end of the lecture, the student must discover ten important problems and appropriate algorithms.

Description

· Basic objects

· Shortest path: Moore-Dijkstra and Ford algorithms.

· Scheduling: PER analysis

· Hamiltonian paths: Demoucron and Kaufman methods - Malgrange

· Eulerian paths

· Maximum flows: Ford-Fulkerson algorithm

· Optimal assignments: Hungarian method

· Properties relating to cycles, trees , Spanning trees with optimal weight: Kruskal's algorithm

· Graph coloring, planar graphs: Euler's formula.

Person(s) in charge
DHAOU RIADH

Bibliography

Graphs and hypergraphs - Author: Claude Berge - Publisher: Dunod, 1975

Graphs and Algorithms - Author: Michel Gondran and Michel Minoux - Editor: Eyrolles, 1980

· Semestre 7 SN FISE Parcours HPC et Big Data

Person(s) in charge
GRATTON SERGE

· Teaching Unit SOFT AND HUMAN SKILLS

Person(s) in charge
HULL ALEXANDRA

· Subject Professional English 2.1 : Presentations

Pre-requisites

None.

Objectives

Perform key oral and written workplace tasks in English.

Targeted skills

1) Deliver an effective scientific or technical presentation in English.

2) Develop your professional network; contact and interview an alumni (in English preferably).

3) Write a report of the alumni interview in English; prepare written documents in English (CV, letter, PowerPoint) for your Personal Professional Project (PPP).

Description

A semester of 12 interactive weekly sessions to develop English intercultural communication competencies for professional purposes.

Number of hours
21 hours

Teaching method
En présence

Teaching language
English

Bibliography

* Gallo, C. (2014). *Talk Like TED: The 9 Public-speaking Secrets of the World's Top Minds.* St. Martin's Press.

* Treu, J. (2014). *Social Wealth: How to Build Extraordinary Relationships By Transforming the Way We Live, Love, Lead and Network.* Be Extraordinary LLC.

* Garner, B. A. (2013). *HBR Guide to Better Business Writing (HBR Guide Series).* Harvard Business Review Press.

· 2nd language

Choice: 1 Among 1 :

· Subject Spanish

· Subject Spanish

· Subject Chinese

· Subject Italian

· Subject Japanese

· Subject Russian

· Subject German

· Subject French as a Foreign Language

· Subject Sports

· Subject Leadership & Management

Person(s) in charge
HULL ALEXANDRA

· Teaching Unit BASE DE LA PROGRAMMATION FONCT ET TRADUCTION DES LANGAGES

Objectives

The objective of the UE is twofold. The student must master the principles of algorithmic and without side effect programming using functional programming. In particular, he must master the concepts of recursion, complexity and termination of the algorithms. It must be able to handle lists and iterators, as well as modules and functors. The associated programming language is the OCaml language.

He must also master the different stages of language translation: lexical analysis, syntaxic analysis and semantic analysis. In the particular case of compilation, he must know four phases of the semantic analysis: the resolution of the identifiers thanks to a table of symbols, the typing, the memory placement of the variables and the code generation. The student will create a compiler that will take a sub-part of C into input language, which will produce code for an abstract stack machine. The compiler will itself be written in OCaml.

Person(s) in charge
HURAULT AURELIE

Bibliography

• OCaml from the very beginning, John Whitington, 2013

• Développement d'applications avec Objective Caml, Emmanuel Chailloux, Pascal Manoury, Bruno Pagano

• Purely Functional Data Structures, Chris Okasaki, 1999

• Compilers: Principles, Techniques, and Tools (dragon book), Alfred V. Aho, Monica S. Lam, Ravi Sethi, and Jeffrey D. Ullman,, 2007

· Subject Programmation Fonctionnelle

Objectives

The student should master the principles of algorithms and programming without side effects using functional programming. He must in particular master the concepts of recursion, complexity and termination of algorithms. He must be able to handle lists and iterators, as well as modules and functors. The practical part is done using the OCaml programming language.

Person(s) in charge
HURAULT AURELIE

· Subject Traduction des Langages

Objectives

The student must master the different stages of language translation: lexical analysis, syntactic analysis and semantic analysis.

In the particular case of compilation, he must know four phases of semantic analysis: resolution of identifiers using a symbol table, typing, memory placement of variables and code generation. The student will realize a compiler that will take in input language a sub-part of C, which will produce code for an abstract stack machine. The compiler itself will be

written in OCaml.

Person(s) in charge
HURAULT AURELIE

· Subject PF et TDL

Objectives

The goal of the Functional Programming and Language Translation project is to extend the compiler made in language translation practical work to handle new constructions (e.g. pointers, arrays, named types, "for" loops, prototypes,...).

The compiler will be written in OCaml and will have to respect the principles of functional programming studied during the courses, tutorials and practical work of functional programming.

Person(s) in charge
HURAULT AURELIE

· Teaching Unit SYSTEMES CONCURRENTS ET COMMUNICANTS

Description

Presentation of basic concepts, principles and mechanisms in concurrent programming and middleware. More precisely:

* modelling and design of parallel systems

* reasoning and evaluation on concurrent programs

* essential design and synchronization patterns

* practice of coarse-grained concurrent programming

* understanding and knowledge of distributed interaction models

* design and programming of applications according to the distributed object model

Person(s) in charge
MAURAN PHILIPPE

Bibliography

* Maurice Herlihy and Nir Shavit : The Art of Multiprocessor Programming, Morgan Kaufmann, 2012

* M. Raynal Concurrent Programming : Algorithms, Principles, and Foundations, Springer 2013

* Fred B. Schneider : On Concurrent Programming, Springer, 1997

* George Coulouris, Jean Dollimore, Tim Kindberg and Gordon Blair : Distributed Systems - Concepts and Design, Addison Wesley 2011

· Subject Systèmes Concurrents

Pre-requisites

Basics of centralized operating systems

Programming in Java language

Objectives

Presentation of the basic concepts, principles and mechanisms of concurrent programming

Targeted skills

design and develop concurrent applications

understand and control the dynamics of a concurrent system

Description

modeling and design of parallel systems

reasoning and evaluation of concurrent applications

essential design and synchronization patterns

practice of coarse-grained concurrent programming

Person(s) in charge
MAURAN PHILIPPE

· Subject Intergiciels

Objectives

Present the principles and basic technologies in the area of middleware, allowing the construction of distributed applications

Description

- the socket interface

- the client-server model and remote invocation tools (RPC, RMI, web services)

- message oriented middleware (JMS)

- application integration (ESB)

Person(s) in charge
HAGIMONT DANIEL

· Subject Projet Données Réparties

Pre-requisites

- concurrent systems

- middlewares

Objectives

- Put into practice the concepts presented in Middlewares and Concurrent Systems

- Manage a project in a group

Description

The project focuses on the creation of a platform to manage concurrent applications operating on shared data, in a centralized and then distributed environment.

It will consist in developing the platform itself, then evaluating it through the development of a panel of applications using this platform.

The requested platform includes, in a simplified way, the functionalities of standard software in the domain. For example, the latest editions of the project are based on the architecture of the Hadoop platform.

Person(s) in charge
MAURAN PHILIPPE

· Teaching Unit THEORIE DES AUTOMATES ET DES LANGAGES, THEORIE DES GRAPHES

Objectives

The objective of the UE is twofold. The student must master the formalisms of finite automata, stack automata and Turing machine for the modeling of state based systems and the implementation of lexical and syntactic analyses. He is also introduced to the computability and complexity theories.

The student must also master the principal concepts and results of Graph Theory and is able to apply them to real life problems and situations. He can implement and test classical algorithms of graph theory, such as Euler's circuit, Disjkstra's shortest path, Welsh-Powell's coloring, etc.

Person(s) in charge
MORIN GÉRALDINE

Bibliography

• Olivier Carton, Langages formels, calculabilité et complexité, Vuibert, 2008 (ISBN 978-2-7117-2077-4)

• Hopcroft, John E.; Motwani, Rajeev; Ullman, Jeffrey D. (2013). Introduction to Automata Theory, Languages, and Computation(3rd ed.). Pearson. ISBN 1292039051.

• Ferdinand Wagner, Ruedi Schmuki, Thomas Wagner et Peter Wolstenholme, Modeling Software with Finite State Machines : A Practical Approach, Auerbach Publications, 2006, 392 p. (ISBN 9780849380860).

* Gondran, Michel, and Michel Minoux. Graphs and algorithms. Wiley, 1984

· Subject Automates

Pre-requisites

Language theory (see the Modelling subject of the Modelling and Programming UE)

Objectives

To discover, understand and know how to exploit the mathematical tools necessary for the formal modeling of the dynamics of discrete systems and for the analysis of structured information: finite automata, stack automata and Turing machines. The subject covers both theoretical and practical aspects through the use of state-of-the-art tools for modeling discrete systems, and the use of formal description languages for the exploitation of structured information.

Targeted skills

Modeling the dynamics of discrete systems using finite automata.

Construction of structured information analysis tools from language models in the form of regular expressions and grammars.

Description

Theoretical and practical study of :

Finite automata

Stacked automata

Structured information analysis techniques

Recursive top-down analysis

Generators of lexical and syntactic parsers

Person(s) in charge
PANTEL MARC

· Subject Graphes

Pre-requisites

Programming skills in ocaml

Objectives

The student must master the principal concepts and results of Graph Theory and is able to apply them to real life problems and situations. He can implement and test classical algorithms of graph theory, such as Euler's circuit, Disjkstra's shortest path, Welsh-Powell's coloring, etc.

Description

Chapter 1 : Definitions and basic concepts

Chapter 2 : Graph connexity

Chapter 3 : Euler and Hamilton graphs

Chapter 4 : Exploring graphs

Chapter 5 : Graph coloring and Planar graphs

Each chapter is studied in class and related exercices are proposed.

5 labs are dedicated to the project.

Number of hours
5 cours-TD, 5 TP

Person(s) in charge
MORIN GÉRALDINE

Bibliography

* Gondran, Michel, and Michel Minoux. Graphs and algorithms. Wiley, 1984

· Teaching Unit GENIE DU LOGICIEL ET DES SYSTEMES

Objectives

Study of the main software engineering principles. Understand and implement design patterns and model driven engineering.

Person(s) in charge
CREGUT XAVIER

Bibliography

• Gamma, Erich; Richard Helm, Ralph Johnson, and John Vlissides (1995). Design Patterns : Elements of Reusable Object-Oriented Software. Addison-Wesley. ISBN 0-201-63361-2.

• Mark Grand. Patterns in Java: A Catalog of Reusable Design Patterns Illustrated with UML, volume 1. Wiley, 2 edition, 2002.

• Sommerville, Ian (2007) [1982]. Software Engineering (8th ed.). Harlow,England : Pearson Education. ISBN 0-321-31379-8

• Model-Driven Software Development : Technology, Engineering, Management (Wiley Software Patterns Series) Thomas Stahl, Markus Voelter, ISBN0-470-02570-0.

• EMF: Eclipse Modeling Framework 2.0 2nd, David Steinberg, Frank Budinsky, Marcelo Paternostro, Ed Merks, Addison-Wesley Professional, 2009 ISBN : 0321331885.

· Subject Génie du Logiciel et des Systèmes

Objectives

Study of the main software engineering principles. Understand and implement design patterns and model driven engineering.

Description

The first part presents main principles of Model-Driven Engineering (MDE): metamodelling (EMF), static semantics (OCL), textual (Xtext) or graphical (Sirius) concrete syntaxes, model to text transformations (Acceleo), model to model transformations (EMF/Java and ATL). A running example is used to illustrate all these concepts and tools.

The second part deals with design patterns, reflection, annotations and test.

Person(s) in charge
CREGUT XAVIER

Bibliography

- Gamma, Erich; Richard Helm, Ralph Johnson, and John Vlissides (1995). Design Patterns : Elements of Reusable Object-Oriented Software. Addison-Wesley. ISBN 0-201-63361-2.

- Mark Grand. Patterns in Java: A Catalog of Reusable Design Patterns Illustrated with UML, volume 1. Wiley, 2 edition, 2002.

- Sommerville, Ian (2007) [1982]. Software Engineering (8th ed.). Harlow, England : Pearson Education. ISBN 0-321-31379-8

- Model-Driven Software Development : Technology, Engineering, Management (Wiley Software Patterns Series) Thomas Stahl, Markus Voelter, ISBN

0-470-02570-0.

- EMF: Eclipse Modeling Framework 2.0 2nd, David Steinberg, Frank Budinsky, Marcelo Paternostro, Ed Merks, Addison-Wesley Professional, 2009 ISBN:0321331885.

· Teaching Unit OPTIMISATION ET R.O.

Description

Students will have the opportunity to become thoroughly familiar with all the results presented in the course of tutorials, in which modeling issues and optimality conditions will be addressed on the basis of various practical optimization problems. A significant amount of practical work will also allow students to implement numerical methods (Newton, Gauss-Newton) and to test them for the treatment of nonlinear least squares problems, as well as on more general optimization problems with constraints.

Databases tend to use simplistic models (entity association, relational) and languages (relational calculus and algebra, SQL). This does not make the representation of a more complex universe so easy; but it allows us to highlight the problems related to the computer storage of files (coherence, confidentiality, etc., and especially redundancy) via the theory of normalization: functional and multi-valued dependencies, Boyce-Codd normal form, third and fourth normal form, etc. Essentially theoretical, this study will conclude, in practical work, with a brief presentation of the main technical tools for files: hash tables and indexes.

Person(s) in charge
RUIZ DANIEL

Bibliography

F.S. Hillier, G.J. Liebermann Operations Research - Mc Graw Hill, Eigth Edition, 2005

Dominique de Werra, Thomas M. Liebling et Jean-Franc#ois He#che. Recherche ope#rationnelle pour inge#nieurs - Presses polytechniques et universitaires romandes. 2003.

· Subject Optimisation

Pre-requisites

First year optimization course

Objectives

The objective of this module is to introduce the theoretical mathematical tools to characterize the local and/or global minima (or maxima) of a real-valued function, with the possible consideration of constraints on the state space.

From these general theoretical aspects, we will develop various algorithms for numerical optimization, and we will study their properties such as global convergence, convergence speed, etc. From a practical point of view, these algorithms will be implemented in the framework of practical work on computers, and tested on various particular problems.

Description

Following the results of the first year course, which gave the necessary/sufficient conditions characterizing the solutions of unconstrained optimization problems, we develop the Karush-Kuhn-Tucker-Lagrange conditions related to the characterization of the optima of a constrained function. These theoretical results are based on particular geometric concepts, such as the cone of admissible directions at a point in the constraint domain. We will analyze these geometrical aspects in detail in the construction of these mathematical results.

As for numerical methods for optimization, we will detail two types of algorithms, one for unconstrained problems, and the other with constraints. In both cases, we will study the convergence of these algorithms and we will focus on some practical aspects such as the choice of relevant stopping criteria, the scaling of the problem variables ...

The students will have the opportunity to familiarize themselves in depth with all the results presented in the framework of tutorial sessions, in which modeling issues and optimality conditions will be addressed on the basis of various practical optimization problems.

A significant amount of practical work will also allow students to implement numerical methods (confidence regions, augmented Lagrangian, etc.) and to test them for the treatment of optimization problems with constraints.

Person(s) in charge
RUIZ DANIEL

Bibliography

Jorge Nocedal and Stephen Wright, Numerical Optimization, Springer, 2006

· Subject Recherche Opérationnelle

Pre-requisites

Basic knowledge of linear algebra, differential calculus, probability theory and programming.

Objectives

Provide the mathematical basis for modeling and solving operations research problems.

Targeted skills

To be able to model and solve Operational Research problems.

Description

The course describes the main methods for modeling and solving Operations Research problems whose objective is decision support. Five projects are proposed to the students who must program in Matlab their solution programs. The course examines in turn linear and integer programming methods (simplex algorithm), maximal flow and tension methods (Ford and Fulkerson algebra), non-zero sum game theory in a non-cooperative game context, Markov chains and trajectory planning in mobile robotics.

Person(s) in charge
MARTHON PHILIPPE

Bibliography

Dominique de Werra, Thomas M. Liebling et Jean-François Hêche. Recherche opérationnelle pour ingénieurs - Presses polytechniques et universitaires romandes. 2003.

· Semestre 7 SN FISE Parcours Systèmes Logiciels

Person(s) in charge
PANTEL MARC

· Teaching Unit SOFT AND HUMAN SKILLS

Person(s) in charge
HULL ALEXANDRA

· Subject Professional English 2.1 : Presentations

Pre-requisites

None.

Objectives

Perform key oral and written workplace tasks in English.

Targeted skills

1) Deliver an effective scientific or technical presentation in English.

2) Develop your professional network; contact and interview an alumni (in English preferably).

3) Write a report of the alumni interview in English; prepare written documents in English (CV, letter, PowerPoint) for your Personal Professional Project (PPP).

Description

A semester of 12 interactive weekly sessions to develop English intercultural communication competencies for professional purposes.

Number of hours
21 hours

Teaching method
En présence

Teaching language
English

Bibliography

* Gallo, C. (2014). *Talk Like TED: The 9 Public-speaking Secrets of the World's Top Minds.* St. Martin's Press.

* Treu, J. (2014). *Social Wealth: How to Build Extraordinary Relationships By Transforming the Way We Live, Love, Lead and Network.* Be Extraordinary LLC.

* Garner, B. A. (2013). *HBR Guide to Better Business Writing (HBR Guide Series).* Harvard Business Review Press.

· 2nd language

Choice: 1 Among 1 :

· Subject Spanish

· Subject Spanish

· Subject Chinese

· Subject Italian

· Subject Japanese

· Subject Russian

· Subject German

· Subject French as a Foreign Language

· Subject Sports

· Subject Leadership & Management

Person(s) in charge
HULL ALEXANDRA

· Teaching Unit SYSTEMES CONCURRENTS ET COMMUNICANTS

Description

Presentation of basic concepts, principles and mechanisms in concurrent programming and middleware. More precisely:

* modelling and design of parallel systems

* reasoning and evaluation on concurrent programs

* essential design and synchronization patterns

* practice of coarse-grained concurrent programming

* understanding and knowledge of distributed interaction models

* design and programming of applications according to the distributed object model

Person(s) in charge
MAURAN PHILIPPE

Bibliography

* Maurice Herlihy and Nir Shavit : The Art of Multiprocessor Programming, Morgan Kaufmann, 2012

* M. Raynal Concurrent Programming : Algorithms, Principles, and Foundations, Springer 2013

* Fred B. Schneider : On Concurrent Programming, Springer, 1997

* George Coulouris, Jean Dollimore, Tim Kindberg and Gordon Blair : Distributed Systems - Concepts and Design, Addison Wesley 2011

· Subject Systèmes Concurrents

Pre-requisites

Basics of centralized operating systems

Programming in Java language

Objectives

Presentation of the basic concepts, principles and mechanisms of concurrent programming

Targeted skills

design and develop concurrent applications

understand and control the dynamics of a concurrent system

Description

modeling and design of parallel systems

reasoning and evaluation of concurrent applications

essential design and synchronization patterns

practice of coarse-grained concurrent programming

Person(s) in charge
MAURAN PHILIPPE

· Subject Intergiciels

Objectives

Present the principles and basic technologies in the area of middleware, allowing the construction of distributed applications

Description

- the socket interface

- the client-server model and remote invocation tools (RPC, RMI, web services)

- message oriented middleware (JMS)

- application integration (ESB)

Person(s) in charge
HAGIMONT DANIEL

· Subject Projet Données Réparties

Pre-requisites

- concurrent systems

- middlewares

Objectives

- Put into practice the concepts presented in Middlewares and Concurrent Systems

- Manage a project in a group

Description

The project focuses on the creation of a platform to manage concurrent applications operating on shared data, in a centralized and then distributed environment.

It will consist in developing the platform itself, then evaluating it through the development of a panel of applications using this platform.

The requested platform includes, in a simplified way, the functionalities of standard software in the domain. For example, the latest editions of the project are based on the architecture of the Hadoop platform.

Person(s) in charge
MAURAN PHILIPPE

· Teaching Unit THEORIE DES AUTOMATES ET DES LANGAGES, THEORIE DES GRAPHES

Objectives

The objective of the UE is twofold. The student must master the formalisms of finite automata, stack automata and Turing machine for the modeling of state based systems and the implementation of lexical and syntactic analyses. He is also introduced to the computability and complexity theories.

The student must also master the principal concepts and results of Graph Theory and is able to apply them to real life problems and situations. He can implement and test classical algorithms of graph theory, such as Euler's circuit, Disjkstra's shortest path, Welsh-Powell's coloring, etc.

Person(s) in charge
MORIN GÉRALDINE

Bibliography

• Olivier Carton, Langages formels, calculabilité et complexité, Vuibert, 2008 (ISBN 978-2-7117-2077-4)

• Hopcroft, John E.; Motwani, Rajeev; Ullman, Jeffrey D. (2013). Introduction to Automata Theory, Languages, and Computation(3rd ed.). Pearson. ISBN 1292039051.

• Ferdinand Wagner, Ruedi Schmuki, Thomas Wagner et Peter Wolstenholme, Modeling Software with Finite State Machines : A Practical Approach, Auerbach Publications, 2006, 392 p. (ISBN 9780849380860).

* Gondran, Michel, and Michel Minoux. Graphs and algorithms. Wiley, 1984

· Subject Automates

Pre-requisites

Language theory (see the Modelling subject of the Modelling and Programming UE)

Objectives

To discover, understand and know how to exploit the mathematical tools necessary for the formal modeling of the dynamics of discrete systems and for the analysis of structured information: finite automata, stack automata and Turing machines. The subject covers both theoretical and practical aspects through the use of state-of-the-art tools for modeling discrete systems, and the use of formal description languages for the exploitation of structured information.

Targeted skills

Modeling the dynamics of discrete systems using finite automata.

Construction of structured information analysis tools from language models in the form of regular expressions and grammars.

Description

Theoretical and practical study of :

Finite automata

Stacked automata

Structured information analysis techniques

Recursive top-down analysis

Generators of lexical and syntactic parsers

Person(s) in charge
PANTEL MARC

· Subject Graphes

Pre-requisites

Programming skills in ocaml

Objectives

The student must master the principal concepts and results of Graph Theory and is able to apply them to real life problems and situations. He can implement and test classical algorithms of graph theory, such as Euler's circuit, Disjkstra's shortest path, Welsh-Powell's coloring, etc.

Description

Chapter 1 : Definitions and basic concepts

Chapter 2 : Graph connexity

Chapter 3 : Euler and Hamilton graphs

Chapter 4 : Exploring graphs

Chapter 5 : Graph coloring and Planar graphs

Each chapter is studied in class and related exercices are proposed.

5 labs are dedicated to the project.

Number of hours
5 cours-TD, 5 TP

Person(s) in charge
MORIN GÉRALDINE

Bibliography

* Gondran, Michel, and Michel Minoux. Graphs and algorithms. Wiley, 1984

· Teaching Unit GENIE DU LOGICIEL ET DES SYSTEMES

Objectives

Study of the main software engineering principles. Understand and implement design patterns and model driven engineering.

Person(s) in charge
CREGUT XAVIER

Bibliography

• Gamma, Erich; Richard Helm, Ralph Johnson, and John Vlissides (1995). Design Patterns : Elements of Reusable Object-Oriented Software. Addison-Wesley. ISBN 0-201-63361-2.

• Mark Grand. Patterns in Java: A Catalog of Reusable Design Patterns Illustrated with UML, volume 1. Wiley, 2 edition, 2002.

• Sommerville, Ian (2007) [1982]. Software Engineering (8th ed.). Harlow,England : Pearson Education. ISBN 0-321-31379-8

• Model-Driven Software Development : Technology, Engineering, Management (Wiley Software Patterns Series) Thomas Stahl, Markus Voelter, ISBN0-470-02570-0.

• EMF: Eclipse Modeling Framework 2.0 2nd, David Steinberg, Frank Budinsky, Marcelo Paternostro, Ed Merks, Addison-Wesley Professional, 2009 ISBN : 0321331885.

· Subject Génie du Logiciel et des Systèmes

Objectives

Study of the main software engineering principles. Understand and implement design patterns and model driven engineering.

Description

The first part presents main principles of Model-Driven Engineering (MDE): metamodelling (EMF), static semantics (OCL), textual (Xtext) or graphical (Sirius) concrete syntaxes, model to text transformations (Acceleo), model to model transformations (EMF/Java and ATL). A running example is used to illustrate all these concepts and tools.

The second part deals with design patterns, reflection, annotations and test.

Person(s) in charge
CREGUT XAVIER

Bibliography

- Gamma, Erich; Richard Helm, Ralph Johnson, and John Vlissides (1995). Design Patterns : Elements of Reusable Object-Oriented Software. Addison-Wesley. ISBN 0-201-63361-2.

- Mark Grand. Patterns in Java: A Catalog of Reusable Design Patterns Illustrated with UML, volume 1. Wiley, 2 edition, 2002.

- Sommerville, Ian (2007) [1982]. Software Engineering (8th ed.). Harlow, England : Pearson Education. ISBN 0-321-31379-8

- Model-Driven Software Development : Technology, Engineering, Management (Wiley Software Patterns Series) Thomas Stahl, Markus Voelter, ISBN

0-470-02570-0.

- EMF: Eclipse Modeling Framework 2.0 2nd, David Steinberg, Frank Budinsky, Marcelo Paternostro, Ed Merks, Addison-Wesley Professional, 2009 ISBN:0321331885.

· Teaching Unit OPTIMISATION ET R.O.

Description

Students will have the opportunity to become thoroughly familiar with all the results presented in the course of tutorials, in which modeling issues and optimality conditions will be addressed on the basis of various practical optimization problems. A significant amount of practical work will also allow students to implement numerical methods (Newton, Gauss-Newton) and to test them for the treatment of nonlinear least squares problems, as well as on more general optimization problems with constraints.

Databases tend to use simplistic models (entity association, relational) and languages (relational calculus and algebra, SQL). This does not make the representation of a more complex universe so easy; but it allows us to highlight the problems related to the computer storage of files (coherence, confidentiality, etc., and especially redundancy) via the theory of normalization: functional and multi-valued dependencies, Boyce-Codd normal form, third and fourth normal form, etc. Essentially theoretical, this study will conclude, in practical work, with a brief presentation of the main technical tools for files: hash tables and indexes.

Person(s) in charge
RUIZ DANIEL

Bibliography

F.S. Hillier, G.J. Liebermann Operations Research - Mc Graw Hill, Eigth Edition, 2005

Dominique de Werra, Thomas M. Liebling et Jean-Franc#ois He#che. Recherche ope#rationnelle pour inge#nieurs - Presses polytechniques et universitaires romandes. 2003.

· Subject Optimisation

Pre-requisites

First year optimization course

Objectives

The objective of this module is to introduce the theoretical mathematical tools to characterize the local and/or global minima (or maxima) of a real-valued function, with the possible consideration of constraints on the state space.

From these general theoretical aspects, we will develop various algorithms for numerical optimization, and we will study their properties such as global convergence, convergence speed, etc. From a practical point of view, these algorithms will be implemented in the framework of practical work on computers, and tested on various particular problems.

Description

Following the results of the first year course, which gave the necessary/sufficient conditions characterizing the solutions of unconstrained optimization problems, we develop the Karush-Kuhn-Tucker-Lagrange conditions related to the characterization of the optima of a constrained function. These theoretical results are based on particular geometric concepts, such as the cone of admissible directions at a point in the constraint domain. We will analyze these geometrical aspects in detail in the construction of these mathematical results.

As for numerical methods for optimization, we will detail two types of algorithms, one for unconstrained problems, and the other with constraints. In both cases, we will study the convergence of these algorithms and we will focus on some practical aspects such as the choice of relevant stopping criteria, the scaling of the problem variables ...

The students will have the opportunity to familiarize themselves in depth with all the results presented in the framework of tutorial sessions, in which modeling issues and optimality conditions will be addressed on the basis of various practical optimization problems.

A significant amount of practical work will also allow students to implement numerical methods (confidence regions, augmented Lagrangian, etc.) and to test them for the treatment of optimization problems with constraints.

Person(s) in charge
RUIZ DANIEL

Bibliography

Jorge Nocedal and Stephen Wright, Numerical Optimization, Springer, 2006

· Subject Recherche Opérationnelle

Pre-requisites

Basic knowledge of linear algebra, differential calculus, probability theory and programming.

Objectives

Provide the mathematical basis for modeling and solving operations research problems.

Targeted skills

To be able to model and solve Operational Research problems.

Description

The course describes the main methods for modeling and solving Operations Research problems whose objective is decision support. Five projects are proposed to the students who must program in Matlab their solution programs. The course examines in turn linear and integer programming methods (simplex algorithm), maximal flow and tension methods (Ford and Fulkerson algebra), non-zero sum game theory in a non-cooperative game context, Markov chains and trajectory planning in mobile robotics.

Person(s) in charge
MARTHON PHILIPPE

Bibliography

Dominique de Werra, Thomas M. Liebling et Jean-François Hêche. Recherche opérationnelle pour ingénieurs - Presses polytechniques et universitaires romandes. 2003.

· Teaching Unit PROGRAMMATION FONCTIONNELLE

Objectives

The objective of the UE is to master the principles of algorithmic and side effect free functional programming. In particular, he must master the concepts of recursion, complexity and termination of the algorithms. He can handle lists, tree-like data structures and their iterators, but also lazy structures such as streams. He can design and give structure to applications through the use of modules, functors and advanced typing schemes. The associated programming language is the OCaml language.

Person(s) in charge
THIRIOUX XAVIER

Bibliography

• OCaml from the very beginning, John Whitington, 2013

• Développement d'applications avec Objective Caml, Emmanuel Chailloux, Pascal Manoury, Bruno Pagano

• Purely Functional Data Structures, Chris Okasaki, 1999

· Subject Programmation Fonctionnelle

Description

Please refer to the UE syllabus, as this is the sole topic in the UE.

Person(s) in charge
THIRIOUX XAVIER

· Semestre 7 SN FISE Parcours Image et Multimédia

Person(s) in charge
CHARVILLAT VINCENT

· Teaching Unit SOFT AND HUMAN SKILLS

Person(s) in charge
HULL ALEXANDRA

· Subject Professional English 2.1 : Presentations

Pre-requisites

None.

Objectives

Perform key oral and written workplace tasks in English.

Targeted skills

1) Deliver an effective scientific or technical presentation in English.

2) Develop your professional network; contact and interview an alumni (in English preferably).

3) Write a report of the alumni interview in English; prepare written documents in English (CV, letter, PowerPoint) for your Personal Professional Project (PPP).

Description

A semester of 12 interactive weekly sessions to develop English intercultural communication competencies for professional purposes.

Number of hours
21 hours

Teaching method
En présence

Teaching language
English

Bibliography

* Gallo, C. (2014). *Talk Like TED: The 9 Public-speaking Secrets of the World's Top Minds.* St. Martin's Press.

* Treu, J. (2014). *Social Wealth: How to Build Extraordinary Relationships By Transforming the Way We Live, Love, Lead and Network.* Be Extraordinary LLC.

* Garner, B. A. (2013). *HBR Guide to Better Business Writing (HBR Guide Series).* Harvard Business Review Press.

· 2nd language

Choice: 1 Among 1 :

· Subject Spanish

· Subject Spanish

· Subject Chinese

· Subject Italian

· Subject Japanese

· Subject Russian

· Subject German

· Subject French as a Foreign Language

· Subject Sports

· Subject Leadership & Management

Person(s) in charge
HULL ALEXANDRA

· Teaching Unit BASE DE LA PROGRAMMATION FONCT ET TRADUCTION DES LANGAGES

Objectives

The objective of the UE is twofold. The student must master the principles of algorithmic and without side effect programming using functional programming. In particular, he must master the concepts of recursion, complexity and termination of the algorithms.

It must be able to handle lists and iterators, as well as modules and functors. The associated programming language is the OCaml language.

He must also master the different stages of language translation: lexical analysis, syntaxic analysis and semantic analysis. In the particular case of compilation, he must know four phases of the semantic analysis: the resolution of the identifiers thanks to a table of symbols, the typing, the memory placement of the variables and the code generation. The student will create a compiler that will take a sub-part of C into input language, which will produce code for an abstract stack machine. The compiler will itself be written in OCaml.

Person(s) in charge
HURAULT AURELIE

Bibliography

• OCaml from the very beginning, John Whitington, 2013

• Développement d'applications avec Objective Caml, Emmanuel Chailloux, Pascal Manoury, Bruno Pagano

• Purely Functional Data Structures, Chris Okasaki, 1999

• Compilers: Principles, Techniques, and Tools (dragon book), Alfred V. Aho, Monica S. Lam, Ravi Sethi, and Jeffrey D. Ullman,, 2007

· Subject Programmation Fonctionnelle

Objectives

The student should master the principles of algorithms and programming without side effects using functional programming. He must in particular master the concepts of recursion, complexity and termination of algorithms. He must be able to handle lists and iterators, as well as modules and functors. The practical part is done using the OCaml programming language.

Person(s) in charge
HURAULT AURELIE

· Subject Traduction des Langages

Objectives

The student must master the different stages of language translation: lexical analysis, syntactic analysis and semantic analysis.

In the particular case of compilation, he must know four phases of semantic analysis: resolution of identifiers using a symbol table, typing, memory placement of variables and code generation. The student will realize a compiler that will take in input language a sub-part of C, which will produce code for an abstract stack machine. The compiler itself will be

written in OCaml.

Person(s) in charge
HURAULT AURELIE

· Subject PF et TDL

Objectives

The goal of the Functional Programming and Language Translation project is to extend the compiler made in language translation practical work to handle new constructions (e.g. pointers, arrays, named types, "for" loops, prototypes,...).

The compiler will be written in OCaml and will have to respect the principles of functional programming studied during the courses, tutorials and practical work of functional programming.

Person(s) in charge
HURAULT AURELIE

· Teaching Unit SYSTEMES CONCURRENTS ET COMMUNICANTS

Description

Presentation of basic concepts, principles and mechanisms in concurrent programming and middleware. More precisely:

* modelling and design of parallel systems

* reasoning and evaluation on concurrent programs

* essential design and synchronization patterns

* practice of coarse-grained concurrent programming

* understanding and knowledge of distributed interaction models

* design and programming of applications according to the distributed object model

Person(s) in charge
MAURAN PHILIPPE

Bibliography

* Maurice Herlihy and Nir Shavit : The Art of Multiprocessor Programming, Morgan Kaufmann, 2012

* M. Raynal Concurrent Programming : Algorithms, Principles, and Foundations, Springer 2013

* Fred B. Schneider : On Concurrent Programming, Springer, 1997

* George Coulouris, Jean Dollimore, Tim Kindberg and Gordon Blair : Distributed Systems - Concepts and Design, Addison Wesley 2011

· Subject Systèmes Concurrents

Pre-requisites

Basics of centralized operating systems

Programming in Java language

Objectives

Presentation of the basic concepts, principles and mechanisms of concurrent programming

Targeted skills

design and develop concurrent applications

understand and control the dynamics of a concurrent system

Description

modeling and design of parallel systems

reasoning and evaluation of concurrent applications

essential design and synchronization patterns

practice of coarse-grained concurrent programming

Person(s) in charge
MAURAN PHILIPPE

· Subject Intergiciels

Objectives

Present the principles and basic technologies in the area of middleware, allowing the construction of distributed applications

Description

- the socket interface

- the client-server model and remote invocation tools (RPC, RMI, web services)

- message oriented middleware (JMS)

- application integration (ESB)

Person(s) in charge
HAGIMONT DANIEL

· Subject Projet Données Réparties

Pre-requisites

- concurrent systems

- middlewares

Objectives

- Put into practice the concepts presented in Middlewares and Concurrent Systems

- Manage a project in a group

Description

The project focuses on the creation of a platform to manage concurrent applications operating on shared data, in a centralized and then distributed environment.

It will consist in developing the platform itself, then evaluating it through the development of a panel of applications using this platform.

The requested platform includes, in a simplified way, the functionalities of standard software in the domain. For example, the latest editions of the project are based on the architecture of the Hadoop platform.

Person(s) in charge
MAURAN PHILIPPE

· Teaching Unit THEORIE DES AUTOMATES ET DES LANGAGES, THEORIE DES GRAPHES

Objectives

The objective of the UE is twofold. The student must master the formalisms of finite automata, stack automata and Turing machine for the modeling of state based systems and the implementation of lexical and syntactic analyses. He is also introduced to the computability and complexity theories.

The student must also master the principal concepts and results of Graph Theory and is able to apply them to real life problems and situations. He can implement and test classical algorithms of graph theory, such as Euler's circuit, Disjkstra's shortest path, Welsh-Powell's coloring, etc.

Person(s) in charge
MORIN GÉRALDINE

Bibliography

• Olivier Carton, Langages formels, calculabilité et complexité, Vuibert, 2008 (ISBN 978-2-7117-2077-4)

• Hopcroft, John E.; Motwani, Rajeev; Ullman, Jeffrey D. (2013). Introduction to Automata Theory, Languages, and Computation(3rd ed.). Pearson. ISBN 1292039051.

• Ferdinand Wagner, Ruedi Schmuki, Thomas Wagner et Peter Wolstenholme, Modeling Software with Finite State Machines : A Practical Approach, Auerbach Publications, 2006, 392 p. (ISBN 9780849380860).

* Gondran, Michel, and Michel Minoux. Graphs and algorithms. Wiley, 1984

· Subject Automates

Pre-requisites

Language theory (see the Modelling subject of the Modelling and Programming UE)

Objectives

To discover, understand and know how to exploit the mathematical tools necessary for the formal modeling of the dynamics of discrete systems and for the analysis of structured information: finite automata, stack automata and Turing machines. The subject covers both theoretical and practical aspects through the use of state-of-the-art tools for modeling discrete systems, and the use of formal description languages for the exploitation of structured information.

Targeted skills

Modeling the dynamics of discrete systems using finite automata.

Construction of structured information analysis tools from language models in the form of regular expressions and grammars.

Description

Theoretical and practical study of :

Finite automata

Stacked automata

Structured information analysis techniques

Recursive top-down analysis

Generators of lexical and syntactic parsers

Person(s) in charge
PANTEL MARC

· Subject Graphes

Pre-requisites

Programming skills in ocaml

Objectives

The student must master the principal concepts and results of Graph Theory and is able to apply them to real life problems and situations. He can implement and test classical algorithms of graph theory, such as Euler's circuit, Disjkstra's shortest path, Welsh-Powell's coloring, etc.

Description

Chapter 1 : Definitions and basic concepts

Chapter 2 : Graph connexity

Chapter 3 : Euler and Hamilton graphs

Chapter 4 : Exploring graphs

Chapter 5 : Graph coloring and Planar graphs

Each chapter is studied in class and related exercices are proposed.

5 labs are dedicated to the project.

Number of hours
5 cours-TD, 5 TP

Person(s) in charge
MORIN GÉRALDINE

Bibliography

* Gondran, Michel, and Michel Minoux. Graphs and algorithms. Wiley, 1984

· Teaching Unit GENIE DU LOGICIEL ET DES SYSTEMES

Objectives

Study of the main software engineering principles. Understand and implement design patterns and model driven engineering.

Person(s) in charge
CREGUT XAVIER

Bibliography

• Gamma, Erich; Richard Helm, Ralph Johnson, and John Vlissides (1995). Design Patterns : Elements of Reusable Object-Oriented Software. Addison-Wesley. ISBN 0-201-63361-2.

• Mark Grand. Patterns in Java: A Catalog of Reusable Design Patterns Illustrated with UML, volume 1. Wiley, 2 edition, 2002.

• Sommerville, Ian (2007) [1982]. Software Engineering (8th ed.). Harlow,England : Pearson Education. ISBN 0-321-31379-8

• Model-Driven Software Development : Technology, Engineering, Management (Wiley Software Patterns Series) Thomas Stahl, Markus Voelter, ISBN0-470-02570-0.

• EMF: Eclipse Modeling Framework 2.0 2nd, David Steinberg, Frank Budinsky, Marcelo Paternostro, Ed Merks, Addison-Wesley Professional, 2009 ISBN : 0321331885.

· Subject Génie du Logiciel et des Systèmes

Objectives

Study of the main software engineering principles. Understand and implement design patterns and model driven engineering.

Description

The first part presents main principles of Model-Driven Engineering (MDE): metamodelling (EMF), static semantics (OCL), textual (Xtext) or graphical (Sirius) concrete syntaxes, model to text transformations (Acceleo), model to model transformations (EMF/Java and ATL). A running example is used to illustrate all these concepts and tools.

The second part deals with design patterns, reflection, annotations and test.

Person(s) in charge
CREGUT XAVIER

Bibliography

- Gamma, Erich; Richard Helm, Ralph Johnson, and John Vlissides (1995). Design Patterns : Elements of Reusable Object-Oriented Software. Addison-Wesley. ISBN 0-201-63361-2.

- Mark Grand. Patterns in Java: A Catalog of Reusable Design Patterns Illustrated with UML, volume 1. Wiley, 2 edition, 2002.

- Sommerville, Ian (2007) [1982]. Software Engineering (8th ed.). Harlow, England : Pearson Education. ISBN 0-321-31379-8

- Model-Driven Software Development : Technology, Engineering, Management (Wiley Software Patterns Series) Thomas Stahl, Markus Voelter, ISBN

0-470-02570-0.

- EMF: Eclipse Modeling Framework 2.0 2nd, David Steinberg, Frank Budinsky, Marcelo Paternostro, Ed Merks, Addison-Wesley Professional, 2009 ISBN:0321331885.

· Teaching Unit OPTIMISATION ET R.O.

Description

Students will have the opportunity to become thoroughly familiar with all the results presented in the course of tutorials, in which modeling issues and optimality conditions will be addressed on the basis of various practical optimization problems. A significant amount of practical work will also allow students to implement numerical methods (Newton, Gauss-Newton) and to test them for the treatment of nonlinear least squares problems, as well as on more general optimization problems with constraints.

Databases tend to use simplistic models (entity association, relational) and languages (relational calculus and algebra, SQL). This does not make the representation of a more complex universe so easy; but it allows us to highlight the problems related to the computer storage of files (coherence, confidentiality, etc., and especially redundancy) via the theory of normalization: functional and multi-valued dependencies, Boyce-Codd normal form, third and fourth normal form, etc. Essentially theoretical, this study will conclude, in practical work, with a brief presentation of the main technical tools for files: hash tables and indexes.

Person(s) in charge
RUIZ DANIEL

Bibliography

F.S. Hillier, G.J. Liebermann Operations Research - Mc Graw Hill, Eigth Edition, 2005

Dominique de Werra, Thomas M. Liebling et Jean-Franc#ois He#che. Recherche ope#rationnelle pour inge#nieurs - Presses polytechniques et universitaires romandes. 2003.

· Subject Optimisation

Pre-requisites

First year optimization course

Objectives

The objective of this module is to introduce the theoretical mathematical tools to characterize the local and/or global minima (or maxima) of a real-valued function, with the possible consideration of constraints on the state space.

From these general theoretical aspects, we will develop various algorithms for numerical optimization, and we will study their properties such as global convergence, convergence speed, etc. From a practical point of view, these algorithms will be implemented in the framework of practical work on computers, and tested on various particular problems.

Description

Following the results of the first year course, which gave the necessary/sufficient conditions characterizing the solutions of unconstrained optimization problems, we develop the Karush-Kuhn-Tucker-Lagrange conditions related to the characterization of the optima of a constrained function. These theoretical results are based on particular geometric concepts, such as the cone of admissible directions at a point in the constraint domain. We will analyze these geometrical aspects in detail in the construction of these mathematical results.

As for numerical methods for optimization, we will detail two types of algorithms, one for unconstrained problems, and the other with constraints. In both cases, we will study the convergence of these algorithms and we will focus on some practical aspects such as the choice of relevant stopping criteria, the scaling of the problem variables ...

The students will have the opportunity to familiarize themselves in depth with all the results presented in the framework of tutorial sessions, in which modeling issues and optimality conditions will be addressed on the basis of various practical optimization problems.

A significant amount of practical work will also allow students to implement numerical methods (confidence regions, augmented Lagrangian, etc.) and to test them for the treatment of optimization problems with constraints.

Person(s) in charge
RUIZ DANIEL

Bibliography

Jorge Nocedal and Stephen Wright, Numerical Optimization, Springer, 2006

· Subject Recherche Opérationnelle

Pre-requisites

Basic knowledge of linear algebra, differential calculus, probability theory and programming.

Objectives

Provide the mathematical basis for modeling and solving operations research problems.

Targeted skills

To be able to model and solve Operational Research problems.

Description

The course describes the main methods for modeling and solving Operations Research problems whose objective is decision support. Five projects are proposed to the students who must program in Matlab their solution programs. The course examines in turn linear and integer programming methods (simplex algorithm), maximal flow and tension methods (Ford and Fulkerson algebra), non-zero sum game theory in a non-cooperative game context, Markov chains and trajectory planning in mobile robotics.

Person(s) in charge
MARTHON PHILIPPE

Bibliography

Dominique de Werra, Thomas M. Liebling et Jean-François Hêche. Recherche opérationnelle pour ingénieurs - Presses polytechniques et universitaires romandes. 2003.

· Semestre 7 SN FISE Parcours Réseaux

· Teaching Unit SOFT AND HUMAN SKILLS

Person(s) in charge
HULL ALEXANDRA

· Subject Professional English 2.1 : Presentations

Pre-requisites

None.

Objectives

Perform key oral and written workplace tasks in English.

Targeted skills

1) Deliver an effective scientific or technical presentation in English.

2) Develop your professional network; contact and interview an alumni (in English preferably).

3) Write a report of the alumni interview in English; prepare written documents in English (CV, letter, PowerPoint) for your Personal Professional Project (PPP).

Description

A semester of 12 interactive weekly sessions to develop English intercultural communication competencies for professional purposes.

Number of hours
21 hours

Teaching method
En présence

Teaching language
English

Bibliography

* Gallo, C. (2014). *Talk Like TED: The 9 Public-speaking Secrets of the World's Top Minds.* St. Martin's Press.

* Treu, J. (2014). *Social Wealth: How to Build Extraordinary Relationships By Transforming the Way We Live, Love, Lead and Network.* Be Extraordinary LLC.

* Garner, B. A. (2013). *HBR Guide to Better Business Writing (HBR Guide Series).* Harvard Business Review Press.

· 2nd language

Choice: 1 Among 1 :

· Subject Spanish

· Subject Spanish

· Subject Chinese

· Subject Italian

· Subject Japanese

· Subject Russian

· Subject German

· Subject French as a Foreign Language

· Subject Sports

· Subject Leadership & Management

Person(s) in charge
HULL ALEXANDRA

· Teaching Unit COMMUNICATIONS NUMERIQUES SUR CANAUX SELECTIFS

Pre-requisites

Bases on telecommunications

Objectives

To be able to define a more complete channel modelization, compared to the one studied druring the first year teaching unit "Bases on Telecommunications".

To be able to implement one of the following techniques to transmit through a time and frequency selective channel:

- Equalization,

- Orthogonal Frequency Division Multiplexing (OFDM),

- Code Division Multiple Access (CDMA).

Targeted skills

Be able to set up a model of the propagation channel to be traversed in order to be able to dimension the physical layer of the transmission system to be implemented.

Be able to set up and size the physical layer of a transmission system to cross a time and frequency selective channel.

Description

This teaching unit presents the telecommunication network physical layer solutions allowing to communicate on time varying and frequency selective channels: equalization, OFDM and CDMA. These solutions are currently used in several telecommunication systems, such as, for example, 3G, 4G, WiFI, ADSL and Digital Terrestrial TV. They rely on channel models described in the first teaching module.

Number of hours
17 lectures, 2 sessions of exercises, 8 sessions of practical work

Person(s) in charge
THOMAS NATHALIE

Teaching method
En présence

Teaching language
French

Bibliography

- John. G. Proakis, Masoud Salehi, « Digital Communications », McGraw-Hill Education, 5th edition (November 6, 2007)

- Sergio Benedetto, Ezio Biglieri, « Principles of digital transmission : with wireless applications », Published in 1999 in New York (N.Y.) by Kluwer Academic/Plenum publishers.

- Raymond Steele, Lajos Hanzo, « Mobile Radio Communications », 2nd Edition, July 1999, Wiley-IEEE Press.

- J. R. Barry, E. A. Lee, and D. G. Messerschmitt, « Digital Communication », 3rd ed., Boston, MA: Kluwer Academic Publishers, 2003.

- B.P. Lathi and Zhi Ding, « Modern Digital and Analog Communication », International 4th ed. New York ; Oxford : Oxford University Press - Oxford series in electrical and computer engineering, 2010.

- Ahmad R. S. Bahai, Burton R. Saltzberg, Mustafa Ergen, « Multi-Carrier Digital Communications: Theory and Applications of OFDM », 2nd ed. New York : Springer, 2004.

- Ramjee Prasad, « OFDM for wireless communications systems », Artech House, 2004.

- Charles E. Cook, Fred. W. Ellersick,. Laurence B. Milstein, and Donald L. Shilling, « Spread Spectrum Communications », Eds. New York, NY: IEEE Press, 1983.

- Don Torrieri, « Principles of Spread-Spectrum Communication Systems », Third Edition,» Springer, 2015.

- Henrik Schulze and Christian Lüders, «Theory and Applications of OFDM and CDMA: Wideband Wireless Communications », John Wiley, January 2006.

· Subject Modélisation de Canal

Objectives

- Defining basic concepts of propagation channel modelling

- Studying main channel models

- Determining relevant parameters

- Classifying channels

- Understanding the main disturbances due to the channel

- Investigating different solutions to overcome these disturbances, in particular diversity techniques, mainly spatial diversity approaches (MIMO).

Description

I. Introduction

II. Large-scale fading (path loss/shadowing)

III. Frequency-flat channels

IV. Frequency-selective channels

V. Parameters and channel characteristics

VI. Diversity principles

VII. Introduction to MIMO techniques

This course is illustrated by practical sessions on cellular planning using ATOLL software, developed by FORSK. These practical sessions are given by an N7 alumni, senior mobile communications Engineer at FORSK.

Person(s) in charge
COULON MARTIAL

Teaching method
En présence

Teaching language
Français

Bibliography

- E. G. Larsson and P. Stoica, Space-Time Block Coding for Wireless Communications, Cambridge University Press, 2008.

- A. Paulraj, R. Nabar and D. Gore, Introduction to Space-Time Wireless Communications, Cambridge University Press, 2008.

- A. Swami, Q. Zhao, Y.M. Hong, L. Tong, Wireless Sensor Networks: Signal Processing And Communications Perspectives, Wiley, 2017.

- E. Dahlman and S. Parkvall, Wireless Sensor Networks: Signal Processing And Communications Perspectives, Academic Press, 2nd edition, 2013.

- J. Proakis and M. Salehi, Digital Communications. New York: McGraw-Hill, 5th ed., 2008.

- T. S. Rappaport, Wireless Communications, Principles and Practice, Second Edition, Prentice Hall PTR, NJ 2014.

- R. Steele and L. Hanzo, Mobile Radio Comunications, Second and Third Generation Cellular and WATM Systems, 2nd ed., John Wiley and Sons, Ltd, New York, 1999.

· Subject Egalisation de Canal

Objectives

The objective of this course is to present detection and estimation methods in the context of frequency selective channels. A particular attention will be given to linear and nonlinear equalization methods with both time-domain or frequency-domain implementation for single-carrier communication systems.

Targeted skills

-To understand the fundamentals of detection and estimation techniques for frequency-selective channel transmissions;

-To be able to derive the discrete baseband equivalent model of a digital communication schemes for a frequency-dispersive channel;

-To know the main methods for detection and equalization;

-To know how to implement a detector and/or equalizer;

-To know how to select the parameters of the different methods to manage the performance/complexity trade-off.

Description

This course presents the methods for detection and estimation over frequency selective channels. The following points will be addressed:

-Modeling frequency selective channels: equivalent discrete baseband channel models, Forney vs Ungerböeck observation model;

-Time domain linear equalization: ZF and MMSE criteria for non-constrained RII filter and RIF;

- Nonlinear equalization: maximum likelihood detection (trellis, Viterbi Algorithm); non-linear filter-based or block-based detection(DFE) ;

- Frequency domain linear equalization : block circular single-carrier waveform; frequency domain equalization (ZF, MMSE); spectral shaping (OFDM precoded SC-OFDM / DFT, EW-SC-OFDM);

The practical lab. sessions are dedicated to the implementation of the algorithms and models seen in this course.

Number of hours
7 courses, 2 Practice Lab courses

Person(s) in charge
POULLIAT CHARLY

Teaching method
En présence

Teaching language
French

Bibliography

[1] B. P. Lathi and Zhi Ding, Modern Digital and Analog Communication Systems, Oxford University Press, 2009.

[2] John Barry, Edward Lee, David Mersserschnitt, Digital Communications, Kluwer Academic Publisher, Third edition.

[3] Andreas F. Molisch, Wireless Communications, 2nd Edition,IEEE Press-Wiley, 2010.

[4] Digital Communications, 4th edition, John G. Proakis, Mc Graw-Hill.

[5] J. Choi, Adaptive and Iterative Signal Processing in Communications, Cambridge University Press, 2006.

[6] Zhi Ding and Ye Li, Blind Equalization and Identification , Marcel Dekker, New York, 2001.

· Subject OFDM/CDMA

Pre-requisites

Bases on telecommunications

Objectives

To be able to implement one of the following techniques to transmit through a time and frequency selective channel:

- Orthogonal Frequency Division Multiplexing (OFDM),

- Code Division Multiple Access (CDMA).

Description

This teaching introduces Orthogonal Frequency Division Multiplexing (OFDM) and Code Division Multiple Access (CDMA), two techniques allowing to transmit on a frequency selective channel and widely used in several communication standards (for 3G, 4G, WiFI, l'ADSL, DTTV...).

Number of hours
6 lectures, 4h of practical work

Person(s) in charge
THOMAS Nathalie
Nathalie.Thomas@enseeiht.fr
Phone 2236

THOMAS NATHALIE

Teaching method
En présence

Teaching language
French

Bibliography

- Ahmad R. S. Bahai, Burton R. Saltzberg, Mustafa Ergen, « Multi-Carrier Digital Communications: Theory and Applications of OFDM », 2nd ed. New York : Springer, 2004.

- Ramjee Prasad, « OFDM for wireless communications systems », Artech House, 2004.

- Charles E. Cook, Fred. W. Ellersick,. Laurence B. Milstein, and Donald L.Shilling, « Spread Spectrum Communications », Eds. New York, NY: IEEE Press, 1983.

- Don Torrieri, « Principles of Spread-Spectrum Communication Systems »,Third Edition,» Springer, 2015.

- Henrik Schulze and Christian Lüders, «Theory and Applications of OFDM and CDMA: Wideband Wireless Communications », John Wiley, January 2006.

· Teaching Unit COMMUNICATION NUMERIQUES CODEES

Pre-requisites

Digital communications (UE N6EN02 "Telecommunications" or equivalent)

Objectives

- be able to dimension a channel coding scheme based on convolutional and cycle codes

- be able to code and decode the proposed codes

- understand the issues of time-frequency-phase synchronization and channel estimation in a receiver

- understand the problematic of data compression

- be able to implement a mobile communications chain and evaluate its performance on MATLAB software

Targeted skills

- be able to define a coding scheme based on convolutional and cyclic codes for the physical layer of a telecommunications system (fixed/mobile, single/multi-carrier)

-be able to model and analyze the communication chain obtained using MATLAB software

- understand the issues of time-frequency-phase synchronization and channel estimation in a receiver

Description

The first part of this unit is devoted to channel coding, and more specifically to the study of convolutional and cyclic codes.

This first part is followed by an introduction to digital receivers and data compression.

The last part of the EU is devoted to the sizing and implementation under MATLAB of a communications chain encoded on a frequency-selective channel.

Number of hours
64

Person(s) in charge
BOUCHERET Marie-laure
Marie-Laure.Boucheret@enseeiht.fr
Phone 2229

MAILHES Corinne
Corinne.Mailhes@enseeiht.fr
Phone 2237

BOUCHERET MARIE LAURE

Teaching method
En présence

Teaching language
French

Bibliography

• « Digital communications », John Proakis, McGraw-Hill Higher Education

• « Channel Codes: Classical and Modern», William Ryan et Shu Lin, Cambridge University Press

· Subject Codage canal

Pre-requisites

Digital communications (UE N6EN02 "Telecommunications" or equivalent)

Objectives

- be able to dimension a channel coding scheme based on convolutional and cyclic codes

- be able to encode and decode the proposed codes

Targeted skills

- be able to define a coding scheme based on convolutional and cyclic codes for the physical layer of a telecommunications system (fixed/mobile, single/multi-carrier)

Description

This module is dedicated to channel coding, and more specifically to the study of convolutional and cyclic codes:

- convolutional codes: state diagram, Viterbi algorithm, punching

- cyclic codes: Galois body, binary BCH codes, Reed-Solomon codes

- concatenated codes

Person(s) in charge
BOUCHERET Marie-laure
Marie-Laure.Boucheret@enseeiht.fr
Phone 2229

BOUCHERET MARIE LAURE

Teaching method
En présence

Teaching language
French

Bibliography

« Channel Codes: Classical and Modern», William Ryan et Shu Lin, Cambridge University Press

· Subject Récepteurs

Pre-requisites

Digital communications (UE N6EN02 "Telecommunications" or equivalent)

Objectives

- understand the issues of time-frequency-phase synchronization and channel estimation in a receiver

- understand the block diagram of a receiver

Targeted skills

- understand the issues of time-frequency-phase synchronization and channel estimation in a receiver

- understand the block diagram of a receiver

Description

This section is devoted to an introduction to digital receivers :

- need for time-frequency synchronization (+ phase in the Gaussian channel) and channel estimation

- block diagram of a satellite receiver

- channel estimation (single and multi-carrier)

Person(s) in charge
BOUCHERET Marie-laure
Marie-Laure.Boucheret@enseeiht.fr

Phone 2229

BOUCHERET MARIE LAURE

Teaching method
En présence

Teaching language
French

· Subject Source Coding

Pre-requisites

Probabilities. Matrix computation

Objectives

Understand what is source coding: lossless or lossy coding methods: lossless linked to information theory and lossy methods based on signal processing, with the 2 big families, predictive coding and transform coding.

Targeted skills

Be able to ask the good questions for source coding: with or without distorsion? And with distorsion, which family of methods?

Description

I. Introduction

II. Lossless coding : basis (information theory in short), Huffman coding, based-dictionary methods, arithmetic coding

III. Lossy coding: the importance of scalar quantization

IV. Lossy coding: predictive coding

V. Lossy coding: transform coding

Number of hours
3 CM de 1h45 + 2 TD de 1h45

Person(s) in charge
MAILHES Corinne
Corinne.Mailhes@enseeiht.fr
Phone 2237

MAILHES CORINNE

Teaching method
En présence

· Subject Projet

Pre-requisites

N7EN02 Digital communications on selective channels

N7EN03A Channel coding

Objectives

- be able to dimension a communication chain on a selective channel (fixed/mobile) according to specifications

- be able to implement this communication chain

- be able to evaluate its performance using MATLAB software

Targeted skills

-be able to design and analyze a communication chain on a selective channel using MATLAB software

Description

This module is dedicated to the dimensioning and implementation using MATLAB of a coded communication chain on a frequency-selective channel. The performance of the chain will also be evaluated.

Person(s) in charge
BOUCHERET MARIE LAURE

Teaching method
En présence

Teaching language
French

· Teaching Unit RESEAUX LOCAUX ET DE TELECOMMUNICATIONS

Description

This teaching unit is dedicated to Local Area Networks and Telecom Networks:

- in the context of Local Area Networks, we mainly focus on Ethernet architecture and its evolution. The second part is dedicated to bridging.

- in the context of Telecom Networks, we will present the different solutions for circuit and packet switching networks.

The main objectives of this course are to understand the principles, the architecture and the protocols of these networks.

Person(s) in charge
BEYLOT ANDRE LUC

Bibliography

Les Réseaux, Guy Pujolle, Eyrolles, Edition 2018

Réseaux Locaux et Internet, Laurent Toutain, Hermès

· Subject Réseaux Locaux

Objectives

At the end of the course, students will be able to recognize the specificities of a local area network, to explain the operation of a local area network architecture, to produce configurations for Ethernet devices, to differentiate between WiFi technologies

Description

1-IEEE architecture and standardization - MAC addressing - concept of bridging - LLC frame exchange and services

2- Ethernet- Segmentation and Virtualization -Frame format- Architectures with and without LLC- Ethernet segmentation: VLANs- InterVLAN communication by router- CoS class of services- Virtual bridging

3- Bridged network: Principle of redundancy - Spaning tree algorithms - STP and RSTP protocols - VLAN and spaning trees - other routings

4- Ethernet link - Bit rate and transmission support - Flow control - Autonegociation - Aggregation - Energy saving

5- WiFi - 802.11 Transmissions and Architectures - Basic MAC access control mechanisms: CSMA / CA and polling – Advanced mechanisms: energy saving and quality of service, multimedia WiFi

Person(s) in charge
PAILLASSA BEATRICE

Teaching language
Francais

· Subject Réseaux de Télécommunications

Pre-requisites

Knowledge of the principles of network operation

Objectives

This subject allows to describe the functioning of telecommunication networks and their specificities in terms of architectures, signaling...

For these different architectures, the main associated protocols will be described.

Targeted skills

Understanding of the functioning of telecommunication networks.

Mastery of the main telecom network architectures.

Person(s) in charge
BEYLOT ANDRE LUC

Bibliography

Les Réseaux, Guy Pujolle, Eyrolles, 2018

· Teaching Unit SYSTEMES CONCURRENTS ET COMMUNICANTS

Description

Presentation of basic concepts, principles and mechanisms in concurrent programming and middleware. More precisely:

* modelling and design of parallel systems

* reasoning and evaluation on concurrent programs

* essential design and synchronization patterns

* practice of coarse-grained concurrent programming

* understanding and knowledge of distributed interaction models

* design and programming of applications according to the distributed object model

Person(s) in charge
MAURAN PHILIPPE

Bibliography

* Maurice Herlihy and Nir Shavit : The Art of Multiprocessor Programming, Morgan Kaufmann, 2012

* M. Raynal Concurrent Programming : Algorithms, Principles, and Foundations, Springer 2013

* Fred B. Schneider : On Concurrent Programming, Springer, 1997

* George Coulouris, Jean Dollimore, Tim Kindberg and Gordon Blair : Distributed Systems - Concepts and Design, Addison Wesley 2011

· Subject Systèmes Concurrents

Pre-requisites

Basics of centralized operating systems

Programming in Java language

Objectives

Presentation of the basic concepts, principles and mechanisms of concurrent programming

Targeted skills

design and develop concurrent applications

understand and control the dynamics of a concurrent system

Description

modeling and design of parallel systems

reasoning and evaluation of concurrent applications

essential design and synchronization patterns

practice of coarse-grained concurrent programming

Person(s) in charge
MAURAN PHILIPPE

· Subject Intergiciels

Objectives

Present the principles and basic technologies in the area of middleware, allowing the construction of distributed applications

Description

- the socket interface

- the client-server model and remote invocation tools (RPC, RMI, web services)

- message oriented middleware (JMS)

- application integration (ESB)

Person(s) in charge
HAGIMONT DANIEL

· Subject Projet Données Réparties

Pre-requisites

- concurrent systems

- middlewares

Objectives

- Put into practice the concepts presented in Middlewares and Concurrent Systems

- Manage a project in a group

Description

The project focuses on the creation of a platform to manage concurrent applications operating on shared data, in a centralized and then distributed environment.

It will consist in developing the platform itself, then evaluating it through the development of a panel of applications using this platform.

The requested platform includes, in a simplified way, the functionalities of standard software in the domain. For example, the latest editions of the project are based on the architecture of the Hadoop platform.

Person(s) in charge
MAURAN PHILIPPE

· Teaching Unit INTERNET ET GRAPHES

Person(s) in charge
FASSON JULIEN

· Subject Internet

Pre-requisites

Basics of communication networks

Objectives

Understand the main technical issues of a network such as the Internet

Analyze the technical solutions proposed by the IP architecture

Understand routing, congestion control, address translation, interconnection, ...

Description

Routing (RIP, OSPF),

congestion control (TCP variants),

address translation,

interconnection (tunneling techniques), ...

Person(s) in charge
CHAPUT EMMANUEL

· Subject Projet Interconnexion

Person(s) in charge
FASSON JULIEN

· Subject Théorie des graphes

Objectives

To discover basic concepts and methods of graph theory from a family of practical problems. At the end of the lecture, the student must discover ten important problems and appropriate algorithms.

Description

· Basic objects

· Shortest path: Moore-Dijkstra and Ford algorithms.

· Scheduling: PER analysis

· Hamiltonian paths: Demoucron and Kaufman methods - Malgrange

· Eulerian paths

· Maximum flows: Ford-Fulkerson algorithm

· Optimal assignments: Hungarian method

· Properties relating to cycles, trees , Spanning trees with optimal weight: Kruskal's algorithm

· Graph coloring, planar graphs: Euler's formula.

Person(s) in charge
DHAOU RIADH

Bibliography

Graphs and hypergraphs - Author: Claude Berge - Publisher: Dunod, 1975

Graphs and Algorithms - Author: Michel Gondran and Michel Minoux - Editor: Eyrolles, 1980

· Semestre 7 SN FISE Parcours Systèmes de Télécommunication

Person(s) in charge
POULLIAT CHARLY

· Teaching Unit SOFT AND HUMAN SKILLS

Person(s) in charge
HULL ALEXANDRA

· Subject Professional English 2.1 : Presentations

Pre-requisites

None.

Objectives

Perform key oral and written workplace tasks in English.

Targeted skills

1) Deliver an effective scientific or technical presentation in English.

2) Develop your professional network; contact and interview an alumni (in English preferably).

3) Write a report of the alumni interview in English; prepare written documents in English (CV, letter, PowerPoint) for your Personal Professional Project (PPP).

Description

A semester of 12 interactive weekly sessions to develop English intercultural communication competencies for professional purposes.

Number of hours
21 hours

Teaching method
En présence

Teaching language
English

Bibliography

* Gallo, C. (2014). *Talk Like TED: The 9 Public-speaking Secrets of the World's Top Minds.* St. Martin's Press.

* Treu, J. (2014). *Social Wealth: How to Build Extraordinary Relationships By Transforming the Way We Live, Love, Lead and Network.* Be Extraordinary LLC.

* Garner, B. A. (2013). *HBR Guide to Better Business Writing (HBR Guide Series).* Harvard Business Review Press.

· 2nd language

Choice: 1 Among 1 :

· Subject Spanish

· **Subject Spanish**

· **Subject Chinese**

· **Subject Italian**

· **Subject Japanese**

· **Subject Russian**

· **Subject German**

· **Subject French as a Foreign Language**

· **Subject Sports**

· **Subject Leadership & Management**

Person(s) in charge
HULL ALEXANDRA

· **Teaching Unit IDM ET INTERGICIELS**

Person(s) in charge
OUEDERNI MERIEM

· **Subject Intergiciel dirigée par les modules**

Person(s) in charge
CREGUT XAVIER

· **Subject Intergiciels**

Person(s) in charge
OUEDERNI MERIEM

· **Subject Introduction aux Applications Web**

Person(s) in charge
HAGIMONT DANIEL

· **Teaching Unit COMMUNICATIONS NUMERIQUES SUR CANAUX SELECTIFS**

Pre-requisites

Bases on telecommunications

Objectives

To be able to define a more complete channel modelization, compared to the one studied druring the first year teaching unit "Bases on Telecommunications".

To be able to implement one of the following techniques to transmit through a time and frequency selective channel:

- Equalization,

- Orthogonal Frequency Division Multiplexing (OFDM),

- Code Division Multiple Access (CDMA).

Targeted skills

Be able to set up a model of the propagation channel to be traversed in order to be able to dimension the physical layer of the transmission system to be implemented.

Be able to set up and size the physical layer of a transmission system to cross a time and frequency selective channel.

Description

This teaching unit presents the telecommunication network physical layer solutions allowing to communicate on time varying and frequency selective channels: equalization, OFDM and CDMA. These solutions are currently used in several telecommunication systems, such as, for example, 3G, 4G, WiFI, ADSL and Digital Terrestrial TV. They rely on channel models described in the first teaching module.

Number of hours
17 lectures, 2 sessions of exercises, 8 sessions of practical work

Person(s) in charge
THOMAS NATHALIE

Teaching method
En présence

Teaching language
French

Bibliography

- John. G. Proakis, Masoud Salehi, « Digital Communications », McGraw-Hill Education, 5th edition (November 6, 2007)

- Sergio Benedetto, Ezio Biglieri, « Principles of digital transmission : with wireless applications », Published in 1999 in New York (N.Y.) by Kluwer Academic/Plenum publishers.

- Raymond Steele, Lajos Hanzo, « Mobile Radio Communications », 2nd Edition, July 1999, Wiley-IEEE Press.

- J. R. Barry, E. A. Lee, and D. G. Messerschmitt, « Digital Communication », 3rd ed., Boston, MA: Kluwer Academic Publishers, 2003.

- B.P. Lathi and Zhi Ding, « Modern Digital and Analog Communication », International 4th ed. New York ; Oxford : Oxford University Press - Oxford series in electrical and computer engineering, 2010.

- Ahmad R. S. Bahai, Burton R. Saltzberg, Mustafa Ergen, « Multi-Carrier Digital Communications: Theory and Applications of OFDM », 2nd ed. New York : Springer, 2004.

- Ramjee Prasad, « OFDM for wireless communications systems », Artech House, 2004.

- Charles E. Cook, Fred. W. Ellersick,. Laurence B. Milstein, and Donald L. Shilling, « Spread Spectrum Communications », Eds. New York, NY: IEEE Press, 1983.

- Don Torrieri, « Principles of Spread-Spectrum Communication Systems », Third Edition,» Springer, 2015.

- Henrik Schulze and Christian Lüders, «Theory and Applications of OFDM and CDMA: Wideband Wireless Communications », John Wiley, January 2006.

· Subject Modélisation de Canal

Objectives

- Defining basic concepts of propagation channel modelling

- Studying main channel models

- Determining relevant parameters

- Classifying channels

- Understanding the main disturbances due to the channel

- Investigating different solutions to overcome these disturbances, in particular diversity techniques, mainly spatial diversity approaches (MIMO).

Description

I. Introduction

II. Large-scale fading (path loss/shadowing)

III. Frequency-flat channels

IV. Frequency-selective channels

V. Parameters and channel characteristics

VI. Diversity principles

VII. Introduction to MIMO techniques

This course is illustrated by practical sessions on cellular planning using ATOLL software, developed by FORSK. These practical sessions are given by an N7 alumni, senior mobile communications Engineer at FORSK.

Person(s) in charge
COULON MARTIAL

Teaching method
En présence

Teaching language
Français

Bibliography

- E. G. Larsson and P. Stoica, Space-Time Block Coding for Wireless Communications, Cambridge University Press, 2008.

- A. Paulraj, R. Nabar and D. Gore, Introduction to Space-Time Wireless Communications, Cambridge University Press, 2008.

- A. Swami, Q. Zhao, Y.M. Hong, L. Tong, Wireless Sensor Networks: Signal Processing And Communications Perspectives, Wiley, 2017.

- E. Dahlman and S. Parkvall, Wireless Sensor Networks: Signal Processing And Communications Perspectives, Academic Press, 2nd edition, 2013.

- J. Proakis and M. Salehi, Digital Communications. New York: McGraw-Hill, 5th ed., 2008.

- T. S. Rappaport, Wireless Communications, Principles and Practice, Second Edition, Prentice Hall PTR, NJ 2014.

- R. Steele and L. Hanzo, Mobile Radio Comunications, Second and Third Generation Cellular and WATM Systems, 2nd ed., John Wiley and Sons, Ltd, New York, 1999.

· Subject Egalisation de Canal

Objectives

The objective of this course is to present detection and estimation methods in the context of frequency selective channels. A particular attention will be given to linear and nonlinear equalization methods with both time-domain or frequency-domain implementation for single-carrier communication systems.

Targeted skills

-To understand the fundamentals of detection and estimation techniques for frequency-selective channel transmissions;

-To be able to derive the discrete baseband equivalent model of a digital communication schemes for a frequency-dispersive channel;

-To know the main methods for detection and equalization;

-To know how to implement a detector and/or equalizer;

-To know how to select the parameters of the different methods to manage the performance/complexity trade-off.

Description

This course presents the methods for detection and estimation over frequency selective channels. The following points will be addressed:

-Modeling frequency selective channels: equivalent discrete baseband channel models, Forney vs Ungerböeck observation model;

-Time domain linear equalization: ZF and MMSE criteria for non-constrained RII filter and RIF;

- Nonlinear equalization: maximum likelihood detection (trellis, Viterbi Algorithm); non-linear filter-based or block-based detection(DFE) ;

- Frequency domain linear equalization : block circular single-carrier waveform; frequency domain equalization (ZF, MMSE); spectral shaping (OFDM precoded SC-OFDM / DFT, EW-SC-OFDM);

The practical lab. sessions are dedicated to the implementation of the algorithms and models seen in this course.

Number of hours
7 courses, 2 Practice Lab courses

Person(s) in charge
POULLIAT CHARLY

Teaching method
En présence

Teaching language
French

Bibliography

[1] B. P. Lathi and Zhi Ding, Modern Digital and Analog Communication Systems, Oxford University Press, 2009.

[2] John Barry, Edward Lee, David Mersserschnitt, Digital Communications, Kluwer Academic Publisher, Third edition.

[3] Andreas F. Molisch, Wireless Communications, 2nd Edition,IEEE Press-Wiley, 2010.

[4] Digital Communications, 4th edition, John G. Proakis, Mc Graw-Hill.

[5] J. Choi, Adaptive and Iterative Signal Processing in Communications, Cambridge University Press, 2006.

[6] Zhi Ding and Ye Li, Blind Equalization and Identification , Marcel Dekker, New York, 2001.

· Subject OFDM/CDMA

Pre-requisites

Bases on telecommunications

Objectives

To be able to implement one of the following techniques to transmit through a time and frequency selective channel:

- Orthogonal Frequency Division Multiplexing (OFDM),

- Code Division Multiple Access (CDMA).

Description

This teaching introduces Orthogonal Frequency Division Multiplexing (OFDM) and Code Division Multiple Access (CDMA), two techniques allowing to transmit on a frequency selective channel and widely used in several communication standards (for 3G, 4G, WiFI, l'ADSL, DTTV...).

Number of hours
6 lectures, 4h of practical work

Person(s) in charge
THOMAS Nathalie
Nathalie.Thomas@enseeiht.fr
Phone 2236

THOMAS NATHALIE

Teaching method
En présence

Teaching language
French

Bibliography

- Ahmad R. S. Bahai, Burton R. Saltzberg, Mustafa Ergen, « Multi-Carrier Digital Communications: Theory and Applications of OFDM », 2nd ed. New York : Springer, 2004.

- Ramjee Prasad, « OFDM for wireless communications systems », Artech House, 2004.

- Charles E. Cook, Fred. W. Ellersick,. Laurence B. Milstein, and Donald L.Shilling, « Spread Spectrum Communications », Eds. New York, NY: IEEE Press, 1983.

- Don Torrieri, « Principles of Spread-Spectrum Communication Systems »,Third Edition,» Springer, 2015.

- Henrik Schulze and Christian Lüders, «Theory and Applications of OFDM and CDMA: Wideband Wireless Communications », John Wiley, January 2006.

· Teaching Unit COMMUNICATION NUMERIQUES CODEES

Pre-requisites

Digital communications (UE N6EN02 "Telecommunications" or equivalent)

Objectives

- be able to dimension a channel coding scheme based on convolutional and cycle codes

- be able to code and decode the proposed codes

- understand the issues of time-frequency-phase synchronization and channel estimation in a receiver

- understand the problematic of data compression

- be able to implement a mobile communications chain and evaluate its performance on MATLAB software

Targeted skills

- be able to define a coding scheme based on convolutional and cyclic codes for the physical layer of a telecommunications system (fixed/mobile, single/multi-carrier)

-be able to model and analyze the communication chain obtained using MATLAB software

- understand the issues of time-frequency-phase synchronization and channel estimation in a receiver

Description

The first part of this unit is devoted to channel coding, and more specifically to the study of convolutional and cyclic codes.

This first part is followed by an introduction to digital receivers and data compression.

The last part of the EU is devoted to the sizing and implementation under MATLAB of a communications chain encoded on a frequency-selective channel.

Number of hours
64

Person(s) in charge
BOUCHERET Marie-laure
Marie-Laure.Boucheret@enseeiht.fr
Phone 2229

MAILHES Corinne
Corinne.Mailhes@enseeiht.fr
Phone 2237

BOUCHERET MARIE LAURE

Teaching method
En présence

Teaching language
French

Bibliography

• « Digital communications », John Proakis, McGraw-Hill Higher Education

• « Channel Codes: Classical and Modern», William Ryan et Shu Lin, Cambridge University Press

· Subject Codage canal

Pre-requisites

Digital communications (UE N6EN02 "Telecommunications" or equivalent)

Objectives

- be able to dimension a channel coding scheme based on convolutional and cyclic codes

- be able to encode and decode the proposed codes

Targeted skills

- be able to define a coding scheme based on convolutional and cyclic codes for the physical layer of a telecommunications system (fixed/mobile, single/multi-carrier)

Description

This module is dedicated to channel coding, and more specifically to the study of convolutional and cyclic codes:

- convolutional codes: state diagram, Viterbi algorithm, punching

- cyclic codes: Galois body, binary BCH codes, Reed-Solomon codes

- concatenated codes

Person(s) in charge
BOUCHERET Marie-laure
Marie-Laure.Boucheret@enseeiht.fr
Phone 2229

BOUCHERET MARIE LAURE

Teaching method
En présence

Teaching language
French

Bibliography

« Channel Codes: Classical and Modern», William Ryan et Shu Lin, Cambridge University Press

· Subject Récepteurs

Pre-requisites

Digital communications (UE N6EN02 "Telecommunications" or equivalent)

Objectives

- understand the issues of time-frequency-phase synchronization and channel estimation in a receiver

- understand the block diagram of a receiver

Targeted skills

- understand the issues of time-frequency-phase synchronization and channel estimation in a receiver

- understand the block diagram of a receiver

Description

This section is devoted to an introduction to digital receivers :

- need for time-frequency synchronization (+ phase in the Gaussian channel) and channel estimation

- block diagram of a satellite receiver

- channel estimation (single and multi-carrier)

Person(s) in charge
BOUCHERET Marie-laure
Marie-Laure.Boucheret@enseeiht.fr
Phone 2229

BOUCHERET MARIE LAURE

Teaching method
En présence

Teaching language
French

· Subject Source Coding

Pre-requisites

Probabilities. Matrix computation

Objectives

Understand what is source coding: lossless or lossy coding methods: lossless linked to information theory and lossy methods based on signal processing, with the 2 big families, predictive coding and transform coding.

Targeted skills

Be able to ask the good questions for source coding: with or without distorsion? And with distorsion, which family of methods?

Description

I. Introduction

II. Lossless coding : basis (information theory in short), Huffman coding, based-dictionary methods, arithmetic coding

III. Lossy coding: the importance of scalar quantization

IV. Lossy coding: predictive coding

V. Lossy coding: transform coding

Number of hours
3 CM de 1h45 + 2 TD de 1h45

Person(s) in charge
MAILHES Corinne
Corinne.Mailhes@enseeiht.fr
Phone 2237

MAILHES CORINNE

Teaching method
En présence

· Subject Projet

Pre-requisites

N7EN02 Digital communications on selective channels

N7EN03A Channel coding

Objectives

- be able to dimension a communication chain on a selective channel (fixed/mobile) according to specifications

- be able to implement this communication chain

- be able to evaluate its performance using MATLAB software

Targeted skills

-be able to design and analyze a communication chain on a selective channel using MATLAB software

Description

This module is dedicated to the dimensioning and implementation using MATLAB of a coded communication chain on a frequency-selective channel. The performance of the chain will also be evaluated.

Person(s) in charge
BOUCHERET MARIE LAURE

Teaching method
En présence

Teaching language
French

· Teaching Unit RESEAUX LOCAUX ET DE TELECOMMUNICATIONS

Description

This teaching unit is dedicated to Local Area Networks and Telecom Networks:

- in the context of Local Area Networks, we mainly focus on Ethernet architecture and its evolution. The second part is dedicated to bridging.

- in the context of Telecom Networks, we will present the different solutions for circuit and packet switching networks.

The main objectives of this course are to understand the principles, the architecture and the protocols of these networks.

Person(s) in charge
BEYLOT ANDRE LUC

Bibliography

Les Réseaux, Guy Pujolle, Eyrolles, Edition 2018

Réseaux Locaux et Internet, Laurent Toutain, Hermès

· Subject Réseaux Locaux

Objectives

At the end of the course, students will be able to recognize the specificities of a local area network, to explain the operation of a local area network architecture, to produce configurations for Ethernet devices, to differentiate between WiFi technologies

Description

1-IEEE architecture and standardization - MAC addressing - concept of bridging - LLC frame exchange and services

2- Ethernet- Segmentation and Virtualization -Frame format- Architectures with and without LLC- Ethernet segmentation: VLANs- InterVLAN communication by router- CoS class of services- Virtual bridging

3- Bridged network: Principle of redundancy - Spaning tree algorithms - STP and RSTP protocols - VLAN and spaning trees - other routings

4- Ethernet link - Bit rate and transmission support - Flow control - Autonegociation - Aggregation - Energy saving

5- WiFi - 802.11 Transmissions and Architectures - Basic MAC access control mechanisms: CSMA / CA and polling – Advanced mechanisms: energy saving and quality of service, multimedia WiFi

Person(s) in charge
PAILLASSA BEATRICE

Teaching language
Francais

· Subject Réseaux de Télécommunications

Pre-requisites

Knowledge of the principles of network operation

Objectives

This subject allows to describe the functioning of telecommunication networks and their specificities in terms of architectures, signaling...

For these different architectures, the main associated protocols will be described.

Targeted skills

Understanding of the functioning of telecommunication networks.

Mastery of the main telecom network architectures.

Person(s) in charge
BEYLOT ANDRE LUC

Bibliography

Les Réseaux, Guy Pujolle, Eyrolles, 2018

· Teaching Unit INTERNET ET GRAPHES

Person(s) in charge
FASSON JULIEN

· Subject Internet

Pre-requisites

Basics of communication networks

Objectives

Understand the main technical issues of a network such as the Internet

Analyze the technical solutions proposed by the IP architecture

Understand routing, congestion control, address translation, interconnection, ...

Description

Routing (RIP, OSPF),

congestion control (TCP variants),

address translation,

interconnection (tunneling techniques), ...

Person(s) in charge
CHAPUT EMMANUEL

· Subject Projet Interconnexion

Person(s) in charge
FASSON JULIEN

· Subject Théorie des graphes

Objectives

To discover basic concepts and methods of graph theory from a family of practical problems. At the end of the lecture, the student must discover ten important problems and appropriate algorithms.

Description

· Basic objects

· Shortest path: Moore-Dijkstra and Ford algorithms.

· Scheduling: PER analysis

· Hamiltonian paths: Demoucron and Kaufman methods - Malgrange

· Eulerian paths

· Maximum flows: Ford-Fulkerson algorithm

· Optimal assignments: Hungarian method

· Properties relating to cycles, trees , Spanning trees with optimal weight: Kruskal's algorithm

· Graph coloring, planar graphs: Euler's formula.

Person(s) in charge
DHAOU RIADH

Bibliography

Graphs and hypergraphs - Author: Claude Berge - Publisher: Dunod, 1975

Graphs and Algorithms - Author: Michel Gondran and Michel Minoux - Editor: Eyrolles, 1980

· Semestre 7 à l'Etranger

Choice: 1 Among 1 :

- **· Teaching Unit Semestre d'Etudes à la TU-Darmstadt (Allemagne)**
- **· Teaching Unit Semestre d'Etudes à l'Université de Hong Kong**
- **· Teaching Unit Sem TU-Delft (Pays-Bas)**
- **· Teaching Unit Semestre d'Etudes Queensland U.T. (Australie)**
- **· Teaching Unit Semestre d'étude à l'université de LEUVEN-KU (Belgique)**
- **· Teaching Unit Semestre d'étude à l'Univ.VAASA (Finlande)**
- **· Teaching Unit Semestre d'études Université de Cordoba (Argentine)**
- **· Teaching Unit Sem. d'études Polytechnic Inst, Ho Chi Minh Ville (Vietnam)**
- **· Teaching Unit Semestre d'étude Pontifica Javeriana, Bogota (Colombie)**
- **· Teaching Unit Semestre d'études Louvain (Univ. Cath) (Belgique)**
- **· Teaching Unit Semestre d'Etudes INHA, Incheon, Corée du Sud**
- **· Teaching Unit Semestre d'Etudes Universidad Nacional de Columbia (UNAL)**
- **· Teaching Unit Semestre à l'Université d'Uppsala (Suède)**
- **· Teaching Unit Sem. Univ.Libre Bruxelles**
- **· Teaching Unit Semestre d'Etudes à l'Université de Lima (Pérou)**
- **· Teaching Unit Semestre d'Etudes à l'Université de Karlsruhe (Allemagne)**
- **· Teaching Unit Semestre d'Etude à l'Université de Hamburg (Allemagne)**
- **· Teaching Unit Semestre d'Etudes à l'Université de La Paz (Bolivie)**

- **Teaching Unit Semestre d'Etudes à Ecole Polytechnique de Montréal (Canada)**
- **Teaching Unit Semestre d'Etudes à l'Université de Stavanger (Norvège)**
- **Teaching Unit Semestre d'Etudes à l'Université de Trondheim (Norvège)**
- **Teaching Unit Semestre à la TU-Berlin (Allemagne)**
- **Teaching Unit Semestre d'Etudes à l'Imperial College de Londres (GB)**
- **Teaching Unit Semestre d'Etudes à l'Univ. d'Auckland (Nouvelle-Zélande)**
- **Teaching Unit Semestre d'Etudes à l'Univ. de Birmingham (UK)**
- **Teaching Unit Semestre d'Etudes à l'Univ. College Cork (Irlande)**
- **Teaching Unit Semestre d'Etudes à l'Univ. de Coventry (UK)**
- **Teaching Unit Semestre d'Etudes à l'Univ. d' Edimbourg (UK)**
- **Teaching Unit Semestre d'Etudes à l'EPFL, Lausanne (Suisse)**
- **Teaching Unit Semestre d'Etudes à la Fac. Polytech. de Mons (Belgique)**
- **Teaching Unit Semestre d'Etudes à l'UFSC, Florianopolis (Brésil)**
- **Teaching Unit Semestre d'Etudes à Georgia Tech, Atlanta (USA)**
- **Teaching Unit Semestre d'Etudes à l'Univ. de Lund (Suède)**
- **Teaching Unit Semestre d'Etudes à la TU-Hambourg (Allemagne)**
- **Teaching Unit Semestre d'Etudes à l'Univ. de Madrid (Espagne)**
- **Teaching Unit Semestre d'Etudes à l'Univ. de Mondragon (Espagne)**
- **Teaching Unit Semestre d'Etudes à l'Univ. de Nottingham (UK)**
- **Teaching Unit Semestre d'Etudes à l'Univ. de Recife (Brésil)**
- **Teaching Unit Semestre d'Etudes à l'Univ. de Saragosse (Espagne)**
- **Teaching Unit Semestre d'Etudes à l'Univ. de Sydney (Australie)**

- **Teaching Unit Semestre d'Etudes à la TU-Brême**
- **Teaching Unit Semestre d'Etudes à la TU-Eindhoven (Pays-Bas)**
- **Teaching Unit Semestre d'Etudes à la TU-Münich (Allemagne)**
- **Teaching Unit Semestre d'Etudes à l'Univ. de Laval (Canada)**
- **Teaching Unit Semestre d'Etudes à l'Université de Bergen (Norvège)**
- **Teaching Unit Semestre d'Etudes à l'Univ. Complutense, Madrid (Espagne)**
- **Teaching Unit Semestre d'Etudes à l'Univ. de Pavie (Italie)**
- **Teaching Unit Semestre d'Etudes à l'Univ. Montréal (Canada)**
- **Teaching Unit Semestre d'Etudes à l'Univ. de Valence (Espagne)**
- **Teaching Unit Semestre d'Etudes à Concordia, Canada**
- **Teaching Unit Semestre d'Etudes à California Davis Univ. , USA**
- **Teaching Unit Semestre ETH Zürich, Suisse**
- **Teaching Unit Semestre Université de Stockholm, Suède**
- **Teaching Unit Semestre d'Etudes à l'Univ. de Purdue (USA)**
- **Teaching Unit Semestre d'Etudes à l'Univ. de Rio UFRJ (Brésil)**
- **Teaching Unit Semestre d'Etudes à l'Université de Concepcion (Chili)**
- **Teaching Unit Semestre d'Etudes à l'Univ. de Dublin DCU (IRL)**
- **Teaching Unit Semestre d'Etudes à l'Univ. de Sherbrooke (CAN)**
- **Teaching Unit Semestre d'Etudes à l'Univ. de Barcelone UPC (ESP)**
- **Teaching Unit Semestre d'Etudes à l'Univ. de Shanghai JTU (Chine)**
- **Teaching Unit Semestre d'Etudes à l'Université de Séville (Espagne)**
- **Teaching Unit Semestre d'Etudes à l'Université de Palerme (Italie)**

· **Teaching Unit Semestre d'Etudes à l'Université de Klagenfurt (Autriche)**

· **Teaching Unit Semestre d'Etudes à l'Université de Pampelune (ESP)**

· **Teaching Unit Semestre d'Etudes à la DTU Copenhague**

· **Teaching Unit Semestre d'Etudes à l'Université d'Arequipa (Pérou)**

· **Teaching Unit Semestre d'Etudes à l'Université de Belfast (GB)**

· **Teaching Unit Semestre d'Etudes à l'ETSEIB Barcelone (Espagne)**

· **Teaching Unit Sem Université de Florence**

· **Teaching Unit Sem EHTP Casablanca (Maroc)**

· **Teaching Unit Sem Univ. Aachen**

· **Teaching Unit Sem Université Stuttgart**

· **Teaching Unit Semestre d'études à l'Université de Cranfield**

· **Teaching Unit Semestre d'étudues au Royal Holoway London**

· **Teaching Unit Sem Aalborg**

· **Teaching Unit Sem St Andrews**

· **Teaching Unit Semestre d'études au Polytec. Turin**

· **Teaching Unit Semestre d'Etudes à l'Université de Chalmers (Suède)**

· **Teaching Unit Semestre d'Etudes à l'Univ. de Cracovie**

· **Teaching Unit Semestre d'Etudes à la Wrije Univ. Bruxelles**

· **Teaching Unit Semestre d'Etudes à l'Univ. de Guadalajara (Mexique)**

· **Teaching Unit Semestre d'Etudes à l'Univ. de Chengdu (Chine)**

· **Teaching Unit Semestre d'Etudes à l'Univ. de Bahia Blanca (Argentine)**

· **Teaching Unit Semestre d'Etudes Erasmus Mundus IMETE**

· **Teaching Unit Semestre d'Etudes Univ. d'Oxford**

· **Teaching Unit Semestre d'études Université de Tomsk, Russie**

· **Teaching Unit Semestre d'études Université de Buenos Aires**

· **Teaching Unit Semestre d'études UPB Bucarest**

· **Teaching Unit Semestre d'Etudes à l'Université de Sonara (Mexique)**

· **Teaching Unit Sem Université Wuhan HUST, Chine**

· **Teaching Unit Sem Université Delhi DTU**

· **Teaching Unit Sem Université de Gdansk, Pologne**

· **Teaching Unit Sem USTH, Hanoï**

· **Teaching Unit Sem Univ. Rome Tor Vergata**

· **Teaching Unit Sem Université Nationale Taïwan**

· **Teaching Unit Sem ETS Montréal**

· **Teaching Unit Sem Université Varsovie**

· **Teaching Unit Semestre d'Etudes à Narvik University College (Norvège)**

· **Teaching Unit Semestre d'Etudes à l'Université de Twente (Pays-Bas)**

· **Teaching Unit Semestre d'études à l'univ. du Pays Basque Bilbao (ESP)**

· **Teaching Unit Sem Technicka Univerzita v Liberci, Liberec, Rép. Tchèque**

· **Teaching Unit Semestre d'Etudes à l'Université de Manchester**

· **Teaching Unit Semestre d'Etudes Université de Chicoutimi, Canada**

· **Teaching Unit Semestre d'Etude à l'Univ. Valparaiso, Chili**

· **Teaching Unit Semestre d'Etudes Séoul National University**

· **Teaching Unit Sem Firenze-UDSDF-Italie**

· **Teaching Unit Sem Constance (Allemagne)**

· **Teaching Unit Semestre à Bologne (Italie)**

· **Teaching Unit Semestre d'Etudes à l'Université d'Amsterdam**

· **Semestre 7 - Hors N7 en France**

Choice: 1 Among 1 :

· **Teaching Unit Semestre d'étude à l'ESC Toulouse**

· **Teaching Unit Semestre IAE Toulouse**

· **Teaching Unit Semestre ESC Rouen**

· **Teaching Unit Semestre EMLyon**

· **Teaching Unit Semestre d'Etudes à l'ISAE**

· **Teaching Unit Semestre d'Etudes à l'ENSIMAG**

· **Teaching Unit Semestre d'étude à Paris 6 Jussieu**

· **Teaching Unit Semestre Université Paris-Dauphine**

· **Teaching Unit Semestre d'études à Télécom Management**

· **Teaching Unit Semestre d'Etudes à Centrale Nantes**

· **Teaching Unit Semestre d'Etudes à l'Ecole Navale, Brest**

· **Teaching Unit Semestre d'études à Sciences Po Paris**

· **Teaching Unit Semestre d'études à Télécom Sud Paris**

· **Teaching Unit Semestre d'étude à Eurecom**

· **Teaching Unit Semestre d'études Toulouse Business School**

· **Teaching Unit Semestre Supelec**

· **Teaching Unit Semestre IFP**

· **Teaching Unit Semestre d'études à l'Université de Montpellier**

· **Teaching Unit Semestre d'études à l'ESSEC**

· **Teaching Unit Semestre ENAC**

· **Teaching Unit Semestre IAE Paris**

· **Teaching Unit Semestre IAE Lyon**

· **Teaching Unit Semestre d'études à l'ENSPM**

· **Teaching Unit Semestre à l'Ecole Polytechnique, Palayseau**

· **Teaching Unit Semestre d'Etudes à l'ENSAE**

· **Teaching Unit Université Paris-Saclay**

· **Teaching Unit Semestre d'études à l'ENM**

· **Teaching Unit Semestre d'études à l'ENSE3**

· **Teaching Unit Semestre d'études à l'ENSTA**

· **Teaching Unit Semestre d'études à HEC Paris**

· **Teaching Unit Semestre A7 Génie des Systèmes Industriels**

· **Teaching Unit Semestre INSTN**

· **Choix de Parcours Semestre 8-2A-SN-FISE**

Choice: 1 Among 1 :

· **Semestre 8 - CESURE**

· **Semestre 8 SN FISE Parcours Architecture Système et Réseaux**

Person(s) in charge
JAKLLARI GENTIAN

· **Teaching Unit Soft and Human Skills**

Person(s) in charge

HULL ALEXANDRA

· Subject Professional English 2.2 : Debates

Pre-requisites

None

Objectives

Perform key oral and written workplace tasks in English.

Targeted skills

1) Develop interactional communication and argumentation skills by actively participating in debates in English.

2) Write an reaction paper effectively in English.

3) Present your professional project convincingly during a job interview in English.

Description

A semester of 12 interactive weekly sessions to develop English intercultural communication competencies for professional purposes.

Number of hours
21 hours

Person(s) in charge
LAKE PETER

Teaching method
En présence

Teaching language
English

Bibliography

* *Heinrichs, J. (2017). Thank you for arguing: What Aristotle, Lincoln, and Homer Simpson can teach us about the art of persuasion.* Three Rivers Press (CA).
* Turabian, K. L. (2010). *Student's guide to writing college papers*. University of Chicago Press.
* Kelley, T. (2017). *Get That Job!: The Quick and Complete Guide to a Winning Interview.* Plovercrest Press.

· Second language

Person(s) in charge
BLANCO ANDRE

Choice: 1 Among 1 :

· Subject Spanish

· Subject Spanish

· Subject Chinese

· Subject Italian

· Subject Japanese

· Subject Russian

· Subject German

· Subject french (as a foreign language)

· Subject Sports

· Subject Leadership & Management

Person(s) in charge
HULL ALEXANDRA

· Teaching Unit APPLICATIONS CONCURRENTES ET COMMUNICANTES, BASE DE DONNES

Description

Putting into practice and context knowledge in concurrent programming,

middleware and databases. More precisely:

* practice and pattern design of fine-grained concurrent programming

* dynamic web application design

* distributed application design

* knowledge of data models

* data modelling theory and practice

Person(s) in charge
HAGIMONT DANIEL

Bibliography

* Maurice Herlihy and Nir Shavit : The Art of Multiprocessor Programming, Morgan Kaufmann, 2012

* Antonio Goncalves, Beginning Java EE 7, Apress, 2013

* Toby J. Teorey,# Sam S. Lightstone,# Tom Nadeau,# H.V. Jagadish, Database Modeling and Design, 5th edition, Morgan Kaufmann, 2011

· Subject Open MP

Pre-requisites

C and/or Fortran programming

Targeted skills

The objective of this course is to provide notions of parallel programming for shared memory, multicore computers using the OpenMP technology. The lectures present the philosophy of the OpenMP programming model and a subset of the OpenMP features including the most commonly used ones such as

- parallel regions

- parallel loops

- synchronizations constructs

- tasks (without and with dependencies)

- locks.

The course includes practice sessions where the concepts presented

in the lectures are used to achieve the parallelization of basic algorithms.

Bibliography

- OpenMP specifications http://openmp.org

- "The OpenMP Common Core. Making OpenMP Simple Again" by Mattson, Koniges, He

- "Using OpenMP - The Next Step. Affinity, Accelerators, Tasking, and SIMD" By Ruud van der Pas, Eric Stotzer and Christian Terboven

· Subject Application Web

Objectives

Present the principles and basic technologies in the area of web applications, allowing the construction of dynamic web sites

Description

- formats and protocoles of the web

- dynamic web pages (servlets, JSP)

- Enterprise Java Bean (EJB, MVC)

- persistence layers (JDBC, JPA)

- JavaScript frameworks (Angular, Jquery)

Person(s) in charge
HAGIMONT DANIEL

· Subject Base de données

Person(s) in charge
OSTERMANN PASCAL

· Subject Projet Application Web

Objectives

The goal is the put into practice the principles and technologies studied in the lectures, by designing a dynamic web site (e-commerce)

Description

- design of a full site

- working in group

- discovering new technologies (self-learning)

Person(s) in charge
HAGIMONT DANIEL

· Subject Projet Données réparties

Objectives

Put into practice the principles and technologies studied in the Middleware and Concurrent Systems lectures.

Description

The project is centered around the implementation of a platform for the support of concurrent applications operating on shared data, initially in a centralized environment, then in a distributed one.

The goal is to develop the platform and then to evaluate it through the development of a set of applications to be run on the platform.

The platform to implement is generally a simplified version of an existing standard plaform. For instance, the last editions of the project were targeting the implementation of a simplified version of the Haddop system.

This project is the continuation of the project conducted during the previous semester, in the "Systèmes Concurrents et Communicants" teaching unit.

Person(s) in charge
MAURAN PHILIPPE

· Teaching Unit SCIENCES ET INGENIERIE DES RESEAUX

Objectives

The purpose of this unit is threefold, addressing the theoretical and practical aspects of network performance, quality of service and the analysis of complex networks.

The goal is, first, to learn to analyze and evaluate the performance of computer systems from stochastic models. We will first study the Markov decision process, which is a general framework for optimizing stochastic models, and in particular Markov chains. We will then study the performance of the most important scheduling policies in practice. We will finish by studying the allocation of resources in networks, with particular attention to TCP

Then we will learn how to analyze complex and dynamic networks and model them using random graphs. Master the notions of small worlds, preferential attachment, temporal graphs. The problems of network analysis are applied to social networks, dynamic network analysis, link analysis, robustness analysis, pandemic analysis (infection times, recovery times, ...), web links analysis (page ranking, ...), measures of centrality, ...

Master spectral analysis tools for complex networks, measurement tools, analysis of dissemination phenomena, communities, ... and interdependence between networks (degrees of correlation, ...).

Person(s) in charge
DHAOU RIADH

Bibliography

- Srikant, R. and Ying, Lei, Communication Networks: An Optimization, Control and Stochastic Networks Perspective, Cambridge University Press (2014)

- M. Harchol-Balter, Performance Modeling and Design of Computer Systems: Queueing Theory in Action, Cambridge University Press, 2013

- S. Ross, Introduction to stochastic dynamic programming, Academic Press, 1983

- Network Science, de Albert-László Barabási, Mars 2016

· Subject Qualité de service

Person(s) in charge
CHAPUT EMMANUEL

· Subject Contrôle et Apprentissage

Objectives

The objective is, first, to learn how to analyze and evaluate the performance of computer systems based on stochastic models.

Description

We will first study Markov decision processes, which is a general framework for optimizing stochastic models, and in particular Markov chains. We will then study the performance of the most important scheduling policies in practice. We will finish by studying the allocation of resources in networks, with particular attention to TCP

Person(s) in charge
AYESTA MORATE URTZI

Bibliography

- Srikant, R. and Ying, Lei, Communication Networks: An Optimization, Control and Stochastic Networks Perspective, Cambridge University Press (2014)

- M. Harchol-Balter, Performance Modeling and Design of Computer Systems: Queueing Theory in Action, Cambridge University Press, 2013

- S. Ross, Introduction to stochastic dynamic programming, Academic Press, 1983

· Subject Science de Réseaux

Pre-requisites

Graph Theory, Statistics, Data Analysis

Objectives

It is an interdisciplinary module, focusing on the science of complex networks and their applications. The content covers mathematical and computational tools for network analysis, their applications to social and dynamic networks, and their use in research on real complex systems. Students learn through the results of ongoing research in the field, and will apply their knowledge in the analysis of real network systems, the main objective of preparing them for a final project.

Description

The following topics are discussed: Network properties: (Density, size, average degree, average path length, diameter, clustering coefficient, connectivity, centrality, influence, etc.), Network models: Random graphs (Erdos-Renyi) , small worlds (Watts-Strogats), preferential attachment (Barabasi-Albert), time graphs, Network analysis: Social network analysis, dynamic network analysis, link analysis, robustness analysis, pandemic analysis (duration of infection , recovery times,…), web link analyzes (page ranking,…), centrality measurements,…, Analysis tools: spectral analysis for complex networks, measurement tools (Gamma tool), Dissemination of content in a network (SIR model): analysis of dissemination phenomena, communities,…, Interdependent networks (degrees of correlation,…).

Person(s) in charge
DHAOU RIADH

Bibliography

Network Science, by Albert-László Barabási, March 2016

· Subject Projet Ingénierie de Réseaux

Pre-requisites

Internet, Local Area Networks, Network performance

Objectives

Understand and observe the main mechanisms contributing to the implementation of quality of service in the Internet.

Description

First we address the issues related to the deployment of QoS by simulation. After a brief description of QoS architectures (IntServ, DiffServ) and QoS mechanisms: classification, measurement, smoothing, policing, scheduler, ... We study TCP congestion control mechanisms (Reno, New Reno, Tahoe) . We illustrate the most classic tools: Leaky / Token Bucket, Round Robin, Deficit Round Robin, FQ, WFQ, RED, We observe the performance of some of these mechanisms through simulations in the NS2 environment. Then we move on to setting up in a Linux / Cisco environment. The students are divided into three projects: IP level QoS, Ethernet level QoS and Load sharing (application, network and link level). The tools used: network configuration tools under linux and under Cisco. Use of hardware, software specific to networks.

Person(s) in charge
DHAOU RIADH

· Teaching Unit ARCHITECTURE DES SYSTEMES D'EXPLOITATION

Objectives

The goal of this UE is to understand the principles for designing operating systems, such as kernel, hardware accesses, hardware protection, drivers, ...

Example of the Linux system is used.

An operating system will be design for a processor implemented unboard a FPGA.

The project aims to define an hardware driver which will control an Ethernet card.

Person(s) in charge
ERMONT JEROME

Bibliography

- Linux Device Drivers, 3rd Edition, O'Reilly

- Understanding the Linux Kernel, 3rd Edition, From I/O Ports to

Process Management, O'Reilly

- Professional Linux Kernel Architecture, Wrox

· Subject Architecture des Systèmes d'Exploitation

Person(s) in charge
ERMONT JEROME

· Teaching Unit INTERCONNEXION ET MODELISATION DES RESEAUX

Person(s) in charge
DHAOU RIADH

· Subject Evaluation de Perfomance

Pre-requisites

Graph Theory, Probability, Statistics, Computer and Telecommunications Networks

Objectives

The objectives of this course are to provide students with the tools necessary to analyze the quantitative performance of networks.

Markov chains (discrete time and continuous time), simple queues and queueing networks will be described.

Numerous examples of computer and telecommunications networks will illustrate the methods.

Person(s) in charge
BEYLOT ANDRE LUC

Bibliography

Queueing Systems, Leonard Kleinrock, Vol 1 et 2, John Wiley

· Subject Simulation de Réseaux

Objectives

This teaching provides elements for choosing the right simulation tool for the performance problem studied. It also raises the questions of validation of simulation results.

Description

First, simple discrete event simulations of queuing networks allowing on the one hand to present and use simulation tools and on the other hand to make students aware of the calculation of confidence intervals and validation of the simulation results. Then, performance studies are carried out with discrete event simulations of network protocols and resource allocation algorithms (random access methods, routing in ad-hoc mobile networks and impact on transport performance, allocation frequencies in mobile networks, rate adaptation in a wireless network) and Monte-Carlo simulations of the load control mechanism of a discretized Aloha type random access). The tools used: Network Simulator (ns-2 and ns-3), Matlab / Simulink.

Person(s) in charge
DHAOU RIADH

· Subject Interconnexion

Person(s) in charge
BEYLOT ANDRE LUC

· Teaching Unit SYSTEMES DE TELECOM SANS FIL ET MOBILES 3

Person(s) in charge
BEYLOT ANDRE LUC

· Subject Réseaux Mobiles

Pre-requisites

Long Distance Networks, Telephone Operator Networks, Local Area Network Architecture

Objectives

The objective of this course is to describe the operation of mobile networks through their evolution. The architectures are described successively through the telecom standards 2G (GSM, GPRS/EDGE), 3G (UMTS, HS(D)PA) and 4G (LTE).

Targeted skills

Design and deploy a mobile network architecture.

Description

Program :

- Introduction: positioning of the different standards

- ITU-T networks: 2G (GSM, GPRS/EDGE), 3G (UMTS, HS(D)PA) and 4G (LTE)

Person(s) in charge
BEYLOT ANDRE LUC

· Subject Réseaux Sans-Fil

Pre-requisites

A good understanding of the TPC/IP. Some basic notions of the wireless physical layer.

Objectives

An in-depth understanding of the key challanges involved in designing protocols for wireless networks. A good understanding of the architectural differences between different wireless technologies.

Targeted skills

Be capable of designing and implementing a wireless network based on a set of requirements stemming from particular user and application needs.

Description

This course presents the main challenges related to the design and implementation of wireless networks and how they are addressed in some of the major technologies in the market, in particular WiFi and Bluetooth.

Person(s) in charge
JAKLLARI GENTIAN

Teaching method
En présence

Teaching language

English

Bibliography

[1] Computer Networking: A Top-Down Approach (7th Edition), by James Kurose, Keith Ross

[2] Mobile Communications (2nd Edition) by Jochen Schiller

· Subject Couches Physique

Pre-requisites

Students must have completed the courses on digital communications, equalization, CDMA, OFDM, channel coding and channel modeling.

Objectives

At the end of the module, the student will propose new transmission techniques for a telecommunications system.

Person(s) in charge
ESCRIG BENOIT

Bibliography

Telecommunications system standards

· Subject Sécurité

Person(s) in charge
MORGAN BENOIT

· Semestre 8 SN FISE Parcours HPC et Big Data

Person(s) in charge
GRATTON SERGE

· Teaching Unit Soft and Human Skills

Person(s) in charge
HULL ALEXANDRA

· Subject Professional English 2.2 : Debates

Pre-requisites

None

Objectives

Perform key oral and written workplace tasks in English.

Targeted skills

1) Develop interactional communication and argumentation skills by actively participating in debates in English.

2) Write an reaction paper effectively in English.

3) Present your professional project convincingly during a job interview in English.

Description

A semester of 12 interactive weekly sessions to develop English intercultural communication competencies for professional purposes.

Number of hours
21 hours

Person(s) in charge
LAKE PETER

Teaching method
En présence

Teaching language
English

Bibliography

* *Heinrichs, J. (2017). Thank you for arguing: What Aristotle, Lincoln, and Homer Simpson can teach us about the art of persuasion.* Three Rivers Press (CA).
* Turabian, K. L. (2010). *Student's guide to writing college papers*. University of Chicago Press.
* Kelley, T. (2017). *Get That Job!: The Quick and Complete Guide to a Winning Interview.* Plovercrest Press.

· Second language

Person(s) in charge
BLANCO ANDRE

Choice: 1 Among 1 :

· Subject Spanish

· Subject Spanish

· Subject Chinese

· Subject Italian

· Subject Japanese

· Subject Russian

· Subject German

· Subject french (as a foreign language)

· Subject Sports

· Subject Leadership & Management

Person(s) in charge
HULL ALEXANDRA

· Teaching Unit APPLICATIONS CONCURRENTES ET COMMUNICANTES, BASE DE DONNES

Description

Putting into practice and context knowledge in concurrent programming,

middleware and databases. More precisely:

* practice and pattern design of fine-grained concurrent programming

* dynamic web application design

* distributed application design

* knowledge of data models

* data modelling theory and practice

Person(s) in charge
HAGIMONT DANIEL

Bibliography

* Maurice Herlihy and Nir Shavit : The Art of Multiprocessor Programming, Morgan Kaufmann, 2012

* Antonio Goncalves, Beginning Java EE 7, Apress, 2013

* Toby J. Teorey,# Sam S. Lightstone,# Tom Nadeau,# H.V. Jagadish, Database Modeling and Design, 5th edition, Morgan Kaufmann, 2011

· Subject Open MP

Pre-requisites

C and/or Fortran programming

Targeted skills

The objective of this course is to provide notions of parallel programming for shared memory, multicore computers using the OpenMP technology. The lectures present the philosophy of the OpenMP programming model and a subset of the OpenMP features including the most commonly used ones such as

- parallel regions

- parallel loops

- synchronizations constructs

- tasks (without and with dependencies)

- locks.

The course includes practice sessions where the concepts presented

in the lectures are used to achieve the parallelization of basic algorithms.

Bibliography

- OpenMP specifications http://openmp.org

- "The OpenMP Common Core. Making OpenMP Simple Again" by Mattson, Koniges, He

- "Using OpenMP - The Next Step. Affinity, Accelerators, Tasking, and SIMD" By Ruud van der Pas, Eric Stotzer and Christian Terboven

· Subject Application Web

Objectives

Present the principles and basic technologies in the area of web applications, allowing the construction of dynamic web sites

Description

- formats and protocoles of the web

- dynamic web pages (servlets, JSP)

- Enterprise Java Bean (EJB, MVC)

- persistence layers (JDBC, JPA)

- JavaScript frameworks (Angular, Jquery)

Person(s) in charge
HAGIMONT DANIEL

· Subject Base de données

Person(s) in charge
OSTERMANN PASCAL

· Subject Projet Application Web

Objectives

The goal is the put into practice the principles and technologies studied in the lectures, by designing a dynamic web site (e-commerce)

Description

- design of a full site

- working in group

- discovering new technologies (self-learning)

Person(s) in charge
HAGIMONT DANIEL

· Subject Projet Données réparties

Objectives

Put into practice the principles and technologies studied in the Middleware and Concurrent Systems lectures.

Description

The project is centered around the implementation of a platform for the support of concurrent applications operating on shared data, initially in a centralized environment, then in a distributed one.

The goal is to develop the platform and then to evaluate it through the development of a set of applications to be run on the platform.

The platform to implement is generally a simplified version of an existing standard plaform. For instance, the last editions of the project were targeting the implementation of a simplified version of the Haddop system.

This project is the continuation of the project conducted during the previous semester, in the "Systèmes Concurrents et Communicants" teaching unit.

Person(s) in charge
MAURAN PHILIPPE

· Teaching Unit ALGEBRE LINEAIRE AVANCEE

Objectives

Knowlegde of numerical methods that are efficient for the solution of large sparse linear systems of equations.

Understand the link between linear algebra and graph processing. Analyse the efficiency of a method with respect to complexity, computing time and memory footprint in the perspective of high performance computing.

Sparse linear algebra will be introduced and used to illustrate all these issues.

Know how to apply specific numerical methods to process matrices occuring in the area of data mining (i.e. non-negative factorization of matrices, partial linear least-square, graph partitioning, K-means clustering, multilinear algebra and tensors).

Person(s) in charge
AMESTOY PATRICK

Bibliography

1/ J. Dongarra, I. Duff, D. Sorensen and H. van der Vorst, Solving Linear Systems on Vector and Shared Memory Computers, SIAM, 1991.

2/ I. Duff, A. Erisman and J.K. Reid. Direct Methods for Sparse Matrices, Second Edition, Oxford University Press, London, 2017.

3/ E. Estrada, M. Fox, G.-L. Oppo and D. J. Higham, Network Science: Complexity in Nature and Technology, Springer, 2010.

· Subject Algèbre Linéaire creuse

Person(s) in charge
AMESTOY PATRICK

· Subject Algèbre Linéaire pour le Data

Person(s) in charge
RUIZ DANIEL

· Subject Prjojet Simulation Numérique

· Teaching Unit CONTROLE ET ANALYSE MULTIRESOLUTION

Pre-requisites

Linear algebra

Integration

Optimization

Differential equation

Objectives

In the first course about optimal control, we introduce the Pontryagin maximum principle and the associated numerical shooting methods to solve optimal control problems. The second course introduces Hilbert spaces and presents applications in data science (RKHS and wavelet).

Number of hours
50

Person(s) in charge
COTS OLIVIER

Teaching method
En présence

Bibliography

- Une exploration des signaux en ondelettes, S. Mallat, Les Editions de l'Ecole Polytechnique, 2000
- Analyse réelle et complexe : Cours et exercices, W. Rudin
- Contrôle optimal : théorie & applications, E. Trélat, Vuibert, Collection "Ma- thématiques Concrètes", 2005

· Subject Analyse hilbertienne pour le traitement des données

Pre-requisites

Linear algebra

Objectives

Hilbert spaces are instrumental for solving problems whose unknown is a function. They are used for solving PDE's when the spectral method is concerned. They provide also a powerful framework for Fourier and Wavelet decomposition. Finally separations results are essential for many convex machine-learning algorithms. The goal of the course is to provide a rigorous exposition of these concepts, and to illustrate them on practical examples from PDE's and signal processing.

Number of hours
24

Person(s) in charge
GRATTON SERGE

Bibliography

- Une exploration des signaux en ondelettes, S. Mallat, Les Editions de l'Ecole Polytechnique, 2000

- Analyse réelle et complexe : Cours et exercices, W. Rudin

· Subject Contrôle Optimal

Pre-requisites

Integration

Optimization

Differential equations

Objectives

We are interested in the numerical resolution of optimal control problems in the ordinary differential equations. An optimal control problem is an optimisation problem in infinite dimension whose unknown (the control) is a function of time. Such problems are coming from many applications: orbital transfer, medical imaging... The goal is to solve efficiently these problems via indirect shooting methods.

Number of hours
26

Person(s) in charge
COTS OLIVIER

Teaching method
En présence

Teaching language
French

Bibliography

- Contrôle optimal : théorie & applications, E. Trélat, Vuibert, Collection "Ma- thématiques Concrètes", 2005

· Teaching Unit APPROXIMATION, INTERPOLATION, EDP

Description

The student knows interpolation and approximation models to fit data of first or second order. He also uses these polynomial or piecewise polynomial representations for modeling parametric curves and surfaces in the context of geometric modeling.

The student knows the finite element discretisation technique for solving partial differential equations. He is able to evaluate gradients of functional using adjoint computations. He also implements these techniques on a computer and is able to evaluate the quality of his solutions in terms of accuracy and performance.

Person(s) in charge
MORIN WEIMER GERALDINE

Bibliography

A practical guide to splines, C. de BOOR, 2001.

Curves and Surfaces for CAGD : A practical guide G. FARIN, 2001. (il existe une traduction en français)

A dynamic programming approach to curves and surfaces for geometric modeling, Ron Goldman, 2002

Subdivision for geometric design: A constructive approach, Warren, Weimer, 2001

· Subject Interpolation et Approximation

Objectives

Learn and practice the classical parametric models that are the basis on 3D modeling within CAD (Computer Aided Design) systems.

Targeted skills

The student knows interpolation and approximation models to fit data of first or second order. He also uses these polynomial or piecewise polynomial representations for modeling parametric curves and surfaces in the context of geometric modeling.

Number of hours
7 CTD, 8 TP (1 projet)

Person(s) in charge
MORIN WEIMER GERALDINE

Teaching method
En présence

Teaching language
Français

Bibliography

A practical guide to splines, C. de BOOR, 2001.

Curves and Surfaces for CAGD : A practical guide G. FARIN, 2001. (il existe une traduction en français)

A dynamic programming approach to curves and surfaces for geometric modeling, Ron Goldman, 2002

Subdivision for geometric design: A constructive approach, Warren, Weimer, 2001

· Subject E.D.P.

Pre-requisites

Lebesgue integral, linear algebra, optimisation

Targeted skills

The student knows how to:

1) discretize partial differential equations by finite elements,

2) use the adjoint method to calculate sensitivities, while controlling numerical errors.

3) program the finite element method on a computer

4) evaluate the computational performance of a software implementation

5) analyze the numerical performance of a solution approach in terms of error

Description

1) Current spaces : L^2, L^p

2) Sobolev spaces, trace theorem

3) Variational form of a problem

4) Principle of the finite element method

5) Convergence of methods

6) Optimization in infinite dimension

Person(s) in charge
GRATTON SERGE

Bibliography
Equations aux dérivées partielles et leurs approximations : Niveau M1, Brigitte Lucquin
Introduction à l'analyse numérique matricielle et à l'optimisation, Patrick Ciarlet

· Teaching Unit APPRENTISSSAGE MACHINE ET OPTIMISATION

Description

Optimisation 2:

Machine learning application often lead to optimisation problems of a composite nature: a typical fit-to-data term is penalized so as to enforce some geometrical properties in the solution. Typical properties include sparcity, low rank in matrices. Such problems are often non-differentiable but convex. We review the most popular sub-gradient based methods for solving such problems, insisting on the convergence properties and the complexity of such methods. We will also focus on efficient implementation of such methods on image processing applications. Finally, we will develop in the SPARK software a movie recommendation system.

Statistique 2:

In this course, the basic regression model is introduced along with its applications and extensions (generalized linear models especially logistic regression). Linear models provide an indispensable basis for later approaches to more modern methods used in big data.

Algorithms will be used in practical works with R to automatically select predictors and a procedure to evaluate the models will be detailled.

Person(s) in charge
GRATTON SERGE

Bibliography

First order methods in optimization, Amir Beck, SIAM

Convex Optimization: Algorithms and Complexity, Sebastian Bubeck

Régression avec R, Cornillon & Matzner-Lober, Springer

An R companion to applied regression, Fox & Weisberg, Sage

· Subject Optimisation 2

Pre-requisites

Basic course on linear algebra, Basic algorithms for unconstrained optimisation

Objectives

Machine learning application often lead to optimisation problems of a composite nature: a typical fit-to-data term is penalized so as to enforce some geometrical properties in the solution. Typical properties include sparcity, low rank in matrices. Such problems are often non-differentiable but convex. We review the most popular sub-gradient based methods for solving

such problems, insisting on the convergence properties and the complexity of such methods. We will also focus on efficient implementation of such methods on image processing applications. Finally, we will develop in the SPARK software a movie recommendation system.

Targeted skills

Know the different first order methods for optimization

Know how to compute the complexity of an optimization algorithm

Know how to compute the subdifferential of a convex function, and if necessary a subgradient

Know how to use Julia and Jupiter Notebook

Know how to build a Spark-based recommendation system

Description

1) Machine learning in artificial intelligence

2) First order methods in the differentiable case: stochastic gradient, mini-batch, ADAM

3) Computation of a subgradient. Subgradient methods and proximal methods

4) Modeling parsimony by convex relaxation (practical)

5) Complexity analysis

6) Development of a film sub-spark recommendation system

Person(s) in charge
GRATTON SERGE

Bibliography

First order methods in optimization, Amir Beck

Convex Optimization: Algorithms and Complexity, Sebastian Bubeck

· Subject Statistique 2

Objectives

In this course, the basic regression model is introduced along with its applications and extensions (generalized linear models especially logistic regression). Linear models provide an indispensable basis for later approaches to more modern methods used in big data. Algorithms will be used in practical works with R to automatically select predictors and a procedure to evaluate the models will be detailled.

Bibliography

Régression avec R, Cornillon & Matzner-Lober, Springer

An R companion to applied regression, Fox & Weisberg, Sage

· Semestre 8 SN FISE Parcours Systèmes Logiciels

Person(s) in charge
PANTEL MARC

· Teaching Unit Soft and Human Skills

Person(s) in charge
HULL ALEXANDRA

· Subject Professional English 2.2 : Debates

Pre-requisites

None

Objectives

Perform key oral and written workplace tasks in English.

Targeted skills

1) Develop interactional communication and argumentation skills by actively participating in debates in English.

2) Write an reaction paper effectively in English.

3) Present your professional project convincingly during a job interview in English.

Description

A semester of 12 interactive weekly sessions to develop English intercultural communication competencies for professional purposes.

Number of hours
21 hours

Person(s) in charge
LAKE PETER

Teaching method
En présence

Teaching language
English

Bibliography

* *Heinrichs, J. (2017). Thank you for arguing: What Aristotle, Lincoln, and Homer Simpson can teach us about the art of persuasion.* Three Rivers Press (CA).
* Turabian, K. L. (2010). *Student's guide to writing college papers*. University of Chicago Press.
* Kelley, T. (2017). *Get That Job!: The Quick and Complete Guide to a Winning Interview.* Plovercrest Press.

· Second language

Person(s) in charge
BLANCO ANDRE

Choice: 1 Among 1 :

· Subject Spanish

· Subject Spanish

· Subject Chinese

· Subject Italian

· Subject Japanese

· Subject Russian

· Subject German

· Subject french (as a foreign language)

· Subject Sports

· Subject Leadership & Management

Person(s) in charge
HULL ALEXANDRA

· Teaching Unit APPLICATIONS CONCURRENTES ET COMMUNICANTES, BASE DE DONNES

Description

Putting into practice and context knowledge in concurrent programming,

middleware and databases. More precisely:

* practice and pattern design of fine-grained concurrent programming

* dynamic web application design

* distributed application design

* knowledge of data models

* data modelling theory and practice

Person(s) in charge
HAGIMONT DANIEL

Bibliography

* Maurice Herlihy and Nir Shavit : The Art of Multiprocessor Programming, Morgan Kaufmann, 2012

* Antonio Goncalves, Beginning Java EE 7, Apress, 2013

* Toby J. Teorey,# Sam S. Lightstone,# Tom Nadeau,# H.V. Jagadish, Database Modeling and Design, 5th edition, Morgan Kaufmann, 2011

· Subject Open MP

Pre-requisites

C and/or Fortran programming

Targeted skills

The objective of this course is to provide notions of parallel programming for shared memory, multicore computers using the OpenMP technology. The lectures present the philosophy of the OpenMP programming model and a subset of the OpenMP features including the most commonly used ones such as

- parallel regions

- parallel loops

- synchronizations constructs

- tasks (without and with dependencies)

- locks.

The course includes practice sessions where the concepts presented

in the lectures are used to achieve the parallelization of basic algorithms.

Bibliography

- OpenMP specifications http://openmp.org

- "The OpenMP Common Core. Making OpenMP Simple Again" by Mattson, Koniges, He

- "Using OpenMP - The Next Step. Affinity, Accelerators, Tasking, and SIMD" By Ruud van der Pas, Eric Stotzer and Christian Terboven

· Subject Application Web

Objectives

Present the principles and basic technologies in the area of web applications, allowing the construction of dynamic web sites

Description

- formats and protocoles of the web

- dynamic web pages (servlets, JSP)

- Enterprise Java Bean (EJB, MVC)

- persistence layers (JDBC, JPA)

- JavaScript frameworks (Angular, Jquery)

Person(s) in charge
HAGIMONT DANIEL

· Subject Base de données

Person(s) in charge
OSTERMANN PASCAL

· Subject Projet Application Web

Objectives

The goal is the put into practice the principles and technologies studied in the lectures, by designing a dynamic web site (e-commerce)

Description

- design of a full site

- working in group

- discovering new technologies (self-learning)

Person(s) in charge
HAGIMONT DANIEL

· Subject Projet Données réparties

Objectives

Put into practice the principles and technologies studied in the Middleware and Concurrent Systems lectures.

Description

The project is centered around the implementation of a platform for the support of concurrent applications operating on shared data, initially in a centralized environment, then in a distributed one.

The goal is to develop the platform and then to evaluate it through the development of a set of applications to be run on the platform.

The platform to implement is generally a simplified version of an existing standard plaform. For instance, the last editions of the project were targeting the implementation of a simplified version of the Haddop system.

This project is the continuation of the project conducted during the previous semester, in the "Systèmes Concurrents et Communicants" teaching unit.

Person(s) in charge
MAURAN PHILIPPE

· Teaching Unit METHODES FORMELLES 1

Description

The first part deals with the modeling, the specification and the

verification of systems, especially concurrent systems. Transition systems are used as a basis for modeling. The linear and arborescent temporal logics LTL et CTL are used to specify safety, liveness and fairness properties. The second part deals with the study of technics and tools for the static and dynamic analysis of programs: deductive approach, model checking, abstract interpretation, test generation, safety analysis.

Person(s) in charge
QUEINNEC PHILIPPE

Bibliography

Specifying Systems (Leslie lamport - Addison-Wesley)

The Temporal Logic of Reactive and Concurrent Systems (Zohar Manna et Amir Pnueli - Springer Verlag)

Principles of Program Analysis (Flemming Nielson and Hanne R. Nielson - Springer)

· Subject Systèmes de transition

Pre-requisites

Mathematical Tools for Computer Science. Concurrent Systems. Automata. Logic and proofs

Objectives

- Formally represent an isolated / autonomous computer system and its executions through the notion of transition system.

- Specify the behavioral properties of such a system in a temporal logic.

- Understand the relation of refinement between specification and implementation, through the notion of module.

- Use a formal modeling and automatic verification tool (TLA+) to illustrate these concepts and verify the properties of the systems.

Description

- Transition systems. Traces and executions.

- Concept of fairness in executions

- Specification in temporal logics: Linear Temporal Logic and Computational Tree Logic.

- Introduction to model verification techniques

Person(s) in charge
QUEINNEC PHILIPPE

Teaching language
français

Bibliography

Specifying Systems (L. Lamport - Addison-Wesley)

· Subject Vérification par Analyse Statique

Pre-requisites

Functional Programming

Modular Imperative Programming

Object and Event Driven Programming

Mathematical tools for computer science

System and Software Engineering

Transition Systems

Objectives

Study of the main constraints and technologies for the development of safety critical systems. Understand and implement static and dynamic analysis technologies: deductive verification, model checking, abstract interpretation

Description

Deductive verification: Hoare logic, Weakest precondition calculus

Model checking: BDD, SMT

Abstract interpretation

Person(s) in charge
THIRIOUX XAVIER

· Teaching Unit PARADIGMES EMERGENTS DE PROGRAMMATION

Objectives

Students know, understand and apply advanced concepts of programming languages (aspects, annotations, mixins, traits, framework, meta-programming, reflection...).

Theoroy of computability and computational complexity.

Person(s) in charge
CREGUT XAVIER

· Subject Programmation Déclarative

Person(s) in charge
PANTEL MARC

· Subject Programmation Avancée et Calculabilité

Objectives

- Know what a calculation is, what a calculation model is, and the limits of what a computer can do (incalculability and undecidability results)

- Understand what the difficulty of a problem means.

- Compare problems in terms of computability and complexity.

- Understand and know how to use idioms and design patterns to structure an application.

Description

The course is composed of two parts. A theoretical part presents the notion of computation through several models of computation, such as Turing machines, recursive functions or quantum computing. It exposes the limits of computation through undecidability and incalculability results. This part also presents the complexity of problems in time (P, NP, NP-completeness) and space (PSPACE). The applied part presents modern approaches to programming: decorators/annotations, control inversion and dependency injection, proxies, aspect programming.

Person(s) in charge
QUEINNEC PHILIPPE

· Teaching Unit SEMANTIQUE ET TRADUCTION DES LANGAGES

Objectives

Know, understand, and know how to use the techniques:

- of formalizing the semantics of programming languages and proving correctness of type checking tools and code generators ;

- construction of interpreters for programs (environment management, type checking, execution) ;

- translation for programs (abstract tree, symbol table, type checking, code generation, optimization, virtual machine).

Person(s) in charge
PANTEL MARC

· Subject Sémantique et Traduction des langages

Pre-requisites

Modeling (see Modeling subject of the Modeling and Programming UE)

Automata and language theory

Objectives

To discover, understand and know how to use the mathematical and computer science tools necessary for formal modeling and the use of the semantics of computer languages in programming tools. The subject covers both theoretical and practical aspects through the use of state-of-the-art tools allowing the construction of analysis and execution tools for programs (interpreter, compiler).

Description

Theoretical and practical study of :

Operational semantics

Axiomatic semantics

Interpreter

Compiler

Static analyzer

Proof of correctness of such tools

Targeted skills

Modeling the semantics of computer languages.

Construction of program analysis tools.

Construction of program execution tools.

Construction of program translation tools.

Person(s) in charge
PANTEL MARC

· Teaching Unit PROGRAMMATION MOBILE ET APPRENTISSAGE PROFOND

Person(s) in charge
CARLIER AXEL

Bibliography

Goodfellow, I., Bengio, Y., Courville, A., & Bengio, Y. (2016). Deep learning (Vol. 1). Cambridge: MIT press.

· Subject Programmation Mobile

Description

This course offers an introduction to Android programming on mobile device with a particular focus on multimedia applications.

In the first part of the course a general overview of the framework and the inner architecture is presented.

Emphasis is placed on the life-cycle of applications, the Android task paradigm, the intent-based communication among applications and the graphical interfaces.

In the second part the course focus on the multimedia aspects of the Android programming with particular attention to the efficient processing of the video stream of the camera.

The course presents two common solutions that enable real-time processing of a large amount of data such as images and video stream: JNI native programming, which take advantage of native code to speed up data-intensive computations, and Renderscript, which offers a high-level API for acceleration that exploits heterogeneous hardware (CPU-GPU).

In the practical part of the course, students get familiar with the general Android frameworks and the different tools required to develop an application (Android Studio, Android Emulator etc) and develop applications to manage video streams and process the camera stream.

Person(s) in charge
GASPARINI SIMONE

Bibliography

- Liang, Sheng (1999). The Java Native Interface: Programmer's Guide and Specification, Addison-Wesley Professional

- Marchetti, Alberto (2016). RenderScript: parallel computing on Android, the easy way

· Subject Apprentissage Profond

Description

In this half-EU, a brief review of the basic notions of supervised learning will first be given. Then we will introduce neural networks and activation functions. We will explain how to train neural networks by gradient descent, introducing cost functions and the gradient backpropagation algorithm.

In a second step, we will introduce convolutional neural networks and their applications in image processing. Finally, we will detail advanced convolutional architectures of the state of the art.

The course is accompanied by practical labs (7 in total) to illustrate and put into practice the course concepts. After a lab on binary classification and a second lab on regression, the 5 remaining labs detail image processing problems (image classification, pose estimation, object detection) and different methods to solve these problems.

Finally, the students have to use the notions seen in class in an image classification project that they will have chosen themselves, and for which they have to build their learning database.

Person(s) in charge
CARLIER AXEL

Bibliography

Goodfellow, I., Bengio, Y., Courville, A., & Bengio, Y. (2016). Deep learning (Vol. 1). Cambridge: MIT press.

· Semestre 8 SN FISE Parcours Image et Multimédia

Person(s) in charge
CHARVILLAT VINCENT

· Teaching Unit Soft and Human Skills

Person(s) in charge
HULL ALEXANDRA

· Subject Professional English 2.2 : Debates

Pre-requisites

None

Objectives

Perform key oral and written workplace tasks in English.

Targeted skills

1) Develop interactional communication and argumentation skills by actively participating in debates in English.

2) Write an reaction paper effectively in English.

3) Present your professional project convincingly during a job interview in English.

Description

A semester of 12 interactive weekly sessions to develop English intercultural communication competencies for professional purposes.

Number of hours
21 hours

Person(s) in charge
LAKE PETER

Teaching method
En présence

Teaching language
English

Bibliography
* *Heinrichs, J. (2017). Thank you for arguing: What Aristotle, Lincoln, and Homer Simpson can teach us about the art of persuasion.* Three Rivers Press (CA).
* Turabian, K. L. (2010). *Student's guide to writing college papers*. University of Chicago Press.
* Kelley, T. (2017). *Get That Job!: The Quick and Complete Guide to a Winning Interview.* Plovercrest Press.

· Second language

Person(s) in charge
BLANCO ANDRE

Choice: 1 Among 1 :

· Subject Spanish

· Subject Spanish

· Subject Chinese

· Subject Italian

· Subject Japanese

· Subject Russian

· Subject German

· Subject french (as a foreign language)

· Subject Sports

· Subject Leadership & Management

Person(s) in charge
HULL ALEXANDRA

· Teaching Unit APPLICATIONS CONCURRENTES ET COMMUNICANTES, BASE DE DONNES

Description

Putting into practice and context knowledge in concurrent programming,

middleware and databases. More precisely:

* practice and pattern design of fine-grained concurrent programming

* dynamic web application design

* distributed application design

* knowledge of data models

* data modelling theory and practice

Person(s) in charge
HAGIMONT DANIEL

Bibliography

* Maurice Herlihy and Nir Shavit : The Art of Multiprocessor Programming, Morgan Kaufmann, 2012

* Antonio Goncalves, Beginning Java EE 7, Apress, 2013

* Toby J. Teorey,# Sam S. Lightstone,# Tom Nadeau,# H.V. Jagadish, Database Modeling and Design, 5th edition, Morgan Kaufmann, 2011

· Subject Open MP

Pre-requisites

C and/or Fortran programming

Targeted skills

The objective of this course is to provide notions of parallel programming for shared memory, multicore computers using the OpenMP technology. The lectures present the philosophy of the OpenMP programming model and a subset of the OpenMP features including the most commonly used ones such as

- parallel regions

- parallel loops

- synchronizations constructs

- tasks (without and with dependencies)

- locks.

The course includes practice sessions where the concepts presented

in the lectures are used to achieve the parallelization of basic algorithms.

Bibliography

- OpenMP specifications http://openmp.org

- "The OpenMP Common Core. Making OpenMP Simple Again" by Mattson, Koniges, He

- "Using OpenMP - The Next Step. Affinity, Accelerators, Tasking, and SIMD" By Ruud van der Pas, Eric Stotzer and Christian Terboven

· Subject Application Web

Objectives

Present the principles and basic technologies in the area of web applications, allowing the construction of dynamic web sites

Description

- formats and protocoles of the web

- dynamic web pages (servlets, JSP)

- Enterprise Java Bean (EJB, MVC)

- persistence layers (JDBC, JPA)

- JavaScript frameworks (Angular, Jquery)

Person(s) in charge
HAGIMONT DANIEL

· Subject Base de données

Person(s) in charge
OSTERMANN PASCAL

· Subject Projet Application Web

Objectives

The goal is the put into practice the principles and technologies studied in the lectures, by designing a dynamic web site (e-commerce)

Description

- design of a full site

- working in group

- discovering new technologies (self-learning)

Person(s) in charge
HAGIMONT DANIEL

· Subject Projet Données réparties

Objectives

Put into practice the principles and technologies studied in the Middleware and Concurrent Systems lectures.

Description

The project is centered around the implementation of a platform for the support of concurrent applications operating on shared data, initially in a centralized environment, then in a distributed one.

The goal is to develop the platform and then to evaluate it through the development of a set of applications to be run on the platform.

The platform to implement is generally a simplified version of an existing standard plaform. For instance, the last editions of the project were targeting the implementation of a simplified version of the Haddop system.

This project is the continuation of the project conducted during the previous semester, in the "Systèmes Concurrents et Communicants" teaching unit.

Person(s) in charge
MAURAN PHILIPPE

· Teaching Unit TRAITEMENT DES DONNES AUDIO-VISUELLES

Objectives

This course aims at introducing students of the Images and Multimedia course to the processing of audio-visual data: image, audio and video. Several families of techniques are presented (see below), which are systematically illustrated by applications. The students can thus acquire a good general culture, and understand that the same application can be carried out using very varied techniques. For example, segmentation can be solved by unsupervised learning or by the variational approach. A particularity of this course is to include as many practical sessions as lectures, in order to find a balance between the acquisition of concepts and their practical appropriation.

Person(s) in charge
DUROU JEAN DENIS

Bibliography

- "Computer Vision: A Modern Approach", David Forsyth et Jean Ponce (Pearson)

- "Practical Image and Video Processing Using Matlab", Oge Marques (Wiley)

· Subject Traitement des données Audio-Visuelles

Person(s) in charge
DUROU JEAN DENIS

· Teaching Unit APPROXIMATION, INTERPOLATION, EDP

Description

The student knows interpolation and approximation models to fit data of first or second order. He also uses these polynomial or piecewise polynomial representations for modeling parametric curves and surfaces in the context of geometric modeling.

The student knows the finite element discretisation technique for solving partial differential equations. He is able to evaluate gradients of functional using adjoint computations. He also implements these techniques on a computer and is able to evaluate the quality of his solutions in terms of accuracy and performance.

Person(s) in charge
MORIN WEIMER GERALDINE

Bibliography

A practical guide to splines, C. de BOOR, 2001.

Curves and Surfaces for CAGD : A practical guide G. FARIN, 2001. (il existe une traduction en français)

A dynamic programming approach to curves and surfaces for geometric modeling, Ron Goldman, 2002

Subdivision for geometric design: A constructive approach, Warren, Weimer, 2001

· Subject Interpolation et Approximation

Objectives

Learn and practice the classical parametric models that are the basis on 3D modeling within CAD (Computer Aided Design) systems.

Targeted skills

The student knows interpolation and approximation models to fit data of first or second order. He also uses these polynomial or piecewise polynomial representations for modeling parametric curves and surfaces in the context of geometric modeling.

Number of hours
7 CTD, 8 TP (1 projet)

Person(s) in charge
MORIN WEIMER GERALDINE

Teaching method
En présence

Teaching language
Français

Bibliography

A practical guide to splines, C. de BOOR, 2001.

Curves and Surfaces for CAGD : A practical guide G. FARIN, 2001. (il existe une traduction en français)

A dynamic programming approach to curves and surfaces for geometric modeling, Ron Goldman, 2002

Subdivision for geometric design: A constructive approach, Warren, Weimer, 2001

· Subject E.D.P.

Pre-requisites

Lebesgue integral, linear algebra, optimisation

Targeted skills

The student knows how to:

1) discretize partial differential equations by finite elements,

2) use the adjoint method to calculate sensitivities, while controlling numerical errors.

3) program the finite element method on a computer

4) evaluate the computational performance of a software implementation

5) analyze the numerical performance of a solution approach in terms of error

Description

1) Current spaces : L^2, L^p

2) Sobolev spaces, trace theorem

3) Variational form of a problem

4) Principle of the finite element method

5) Convergence of methods

6) Optimization in infinite dimension

Person(s) in charge
GRATTON SERGE

Bibliography
Equations aux dérivées partielles et leurs approximations : Niveau M1, Brigitte Lucquin
Introduction à l'analyse numérique matricielle et à l'optimisation, Patrick Ciarlet

· Teaching Unit IMAGE, RENDU, MODELISATION

Pre-requisites

Programming and mathemathics of the first year.

Objectives

The objective of this course is to discover and learn the notions related to the analysis of scenes by identifying low level primitives (contours) and high level primitives (superpixels). The student will also study the classical rendering pipeline and how to implement it. Finally, the notions of surface reconstruction (triangulation) based on the median axis will be studied.

Targeted skills

- Discovering image processing

- Learning basic notions of low level image processing

- Discovering and understanding the rendering pipelineLearning how to implement - image processing and rendering solutions

Person(s) in charge
MARTHON PHILIPPE

Bibliography

Richard Szeliski, Computer Vision: Algorithms and Applications, 2010. (http://szeliski.org/Book/)

· Subject Traitement Image

Objectives

1) Introduction to main image processing: image enhancement and restoration, edge detection and segmentation in order to give the student an overview of the existing classical techniques.

2) Guided discovery of segmentation approaches with practical work: from the most classical approaches, such as mean shift, to the most recent approaches based on superpixels.

Targeted skills

1) Discover the classical image processing techniques: edge detection, image enhancement, segmentation

2) To understand deeply these techniques through practical work and projects

Teaching method
Hybride

Bibliography

1) W. K. Pratt. Digital image processing. Wiley-Interscience Publication, New-York, États-Unis, 1978.

2) R. Horaud and O. Monga. Vision par ordinateur, outils fondamentaux. Traité des nouvelles technologies, série Informatique. Hermès, Paris, France, 1993.

· Subject Modélisation

Objectives

1) Learning how to implement a complete rendering pipeline through practical work.

2) Practical application of a 2D shape analysis method: from the detection of its skeleton to the 3D reconstruction of the shape.

Targeted skills

1) Understand classic segmentation techniques

2) Implement a complete rendering pipeline

3) Learn how to propose an approach adapted to a concrete problem to carry out the analysis of a 2D shape in an image

Person(s) in charge

MARTHON PHILIPPE

Teaching method
Hybride

Bibliography

1) Fundamentals of computer graphics, Peter Shirley, Steve Marschner, 2009

2) An integrated introduction to computer graphics and geometric modeling, Ronald Goldman, 2009

3) Computational geometry : algorithms and applications, Mark de Berg, Marc van Kreveld, Mark Overmars, 2000.

· Teaching Unit PROGRAMMATION MOBILE ET APPRENTISSAGE PROFOND

Person(s) in charge
CARLIER AXEL

Bibliography

Goodfellow, I., Bengio, Y., Courville, A., & Bengio, Y. (2016). Deep learning (Vol. 1). Cambridge: MIT press.

· Subject Programmation Mobile

Description

This course offers an introduction to Android programming on mobile device with a particular focus on multimedia applications.

In the first part of the course a general overview of the framework and the inner architecture is presented.

Emphasis is placed on the life-cycle of applications, the Android task paradigm, the intent-based communication among applications and the graphical interfaces.

In the second part the course focus on the multimedia aspects of the Android programming with particular attention to the efficient processing of the video stream of the camera.

The course presents two common solutions that enable real-time processing of a large amount of data such as images and video stream: JNI native programming, which take advantage of native code to speed up data-intensive computations, and Renderscript, which offers a high-level API for acceleration that exploits heterogeneous hardware (CPU-GPU).

In the practical part of the course, students get familiar with the general Android frameworks and the different tools required to develop an application (Android Studio, Android Emulator etc) and develop applications to manage video streams and process the camera stream.

Person(s) in charge
GASPARINI SIMONE

Bibliography

- Liang, Sheng (1999). The Java Native Interface: Programmer's Guide and Specification, Addison-Wesley Professional

- Marchetti, Alberto (2016). RenderScript: parallel computing on Android, the easy way

· Subject Apprentissage Profond

Description

In this half-EU, a brief review of the basic notions of supervised learning will first be given. Then we will introduce neural networks and activation functions. We will explain how to train neural networks by gradient descent, introducing cost functions and the gradient backpropagation algorithm.

In a second step, we will introduce convolutional neural networks and their applications in image processing. Finally, we will detail advanced convolutional architectures of the state of the art.

The course is accompanied by practical labs (7 in total) to illustrate and put into practice the course concepts. After a lab on binary classification and a second lab on regression, the 5 remaining labs detail image processing problems (image classification, pose estimation, object detection) and different methods to solve these problems.

Finally, the students have to use the notions seen in class in an image classification project that they will have chosen themselves, and for which they have to build their learning database.

Person(s) in charge
CARLIER AXEL

Bibliography

Goodfellow, I., Bengio, Y., Courville, A., & Bengio, Y. (2016). Deep learning (Vol. 1). Cambridge: MIT press.

· Semestre 8 SN FISE Parcours Réseaux

Person(s) in charge
JAKLLARI GENTIAN

· Teaching Unit Soft and Human Skills

Person(s) in charge
HULL ALEXANDRA

· Subject Professional English 2.2 : Debates

Pre-requisites

None

Objectives

Perform key oral and written workplace tasks in English.

Targeted skills

1) Develop interactional communication and argumentation skills by actively participating in debates in English.

2) Write an reaction paper effectively in English.

3) Present your professional project convincingly during a job interview in English.

Description

A semester of 12 interactive weekly sessions to develop English intercultural communication competencies for professional purposes.

Number of hours

21 hours

Person(s) in charge
LAKE PETER

Teaching method
En présence

Teaching language
English

Bibliography
* *Heinrichs, J. (2017). Thank you for arguing: What Aristotle, Lincoln, and Homer Simpson can teach us about the art of persuasion.* Three Rivers Press (CA).
* Turabian, K. L. (2010). *Student's guide to writing college papers*. University of Chicago Press.
* Kelley, T. (2017). *Get That Job!: The Quick and Complete Guide to a Winning Interview.* Plovercrest Press.

· Second language

Person(s) in charge
BLANCO ANDRE

Choice: 1 Among 1 :

· Subject Spanish

· Subject Spanish

· Subject Chinese

· Subject Italian

· Subject Japanese

· Subject Russian

· Subject German

· Subject french (as a foreign language)

· Subject Sports

· Subject Leadership & Management

Person(s) in charge
HULL ALEXANDRA

· Teaching Unit SCIENCES ET INGENIERIE DES RESEAUX

Objectives

The purpose of this unit is threefold, addressing the theoretical and practical aspects of network performance, quality of service and the analysis of complex networks.

The goal is, first, to learn to analyze and evaluate the performance of computer systems from stochastic models. We will first study the Markov decision process, which is a general framework for optimizing stochastic models, and in particular Markov chains. We will then study the performance of the most important scheduling policies in practice. We will finish by studying the allocation of resources in networks, with particular attention to TCP

Then we will learn how to analyze complex and dynamic networks and model them using random graphs. Master the notions of small worlds, preferential attachment, temporal graphs. The problems of network analysis are applied to social networks, dynamic network analysis, link analysis, robustness analysis, pandemic analysis (infection times, recovery times, ...), web links analysis (page ranking, ...), measures of centrality, ...

Master spectral analysis tools for complex networks, measurement tools, analysis of dissemination phenomena, communities, ... and interdependence between networks (degrees of correlation, ...).

Person(s) in charge
DHAOU RIADH

Bibliography

- Srikant, R. and Ying, Lei, Communication Networks: An Optimization, Control and Stochastic Networks Perspective, Cambridge University Press (2014)

- M. Harchol-Balter, Performance Modeling and Design of Computer Systems: Queueing Theory in Action, Cambridge University Press, 2013

- S. Ross, Introduction to stochastic dynamic programming, Academic Press, 1983

- Network Science, de Albert-László Barabási, Mars 2016

· Subject Qualité de service

Person(s) in charge
CHAPUT EMMANUEL

· Subject Contrôle et Apprentissage

Objectives

The objective is, first, to learn how to analyze and evaluate the performance of computer systems based on stochastic models.

Description

We will first study Markov decision processes, which is a general framework for optimizing stochastic models, and in particular Markov chains. We will then study the performance of the most important scheduling policies in practice. We will finish by studying the allocation of resources in networks, with particular attention to TCP

Person(s) in charge
AYESTA MORATE URTZI

Bibliography

- Srikant, R. and Ying, Lei, Communication Networks: An Optimization, Control and Stochastic Networks Perspective, Cambridge University Press (2014)

- M. Harchol-Balter, Performance Modeling and Design of Computer Systems: Queueing Theory in Action, Cambridge University Press, 2013

- S. Ross, Introduction to stochastic dynamic programming, Academic Press, 1983

· Subject Science de Réseaux

Pre-requisites

Graph Theory, Statistics, Data Analysis

Objectives

It is an interdisciplinary module, focusing on the science of complex networks and their applications. The content covers mathematical and computational tools for network analysis, their applications to social and dynamic networks, and their use in research on real complex systems. Students learn through the results of ongoing research in the field, and will apply their knowledge in the analysis of real network systems, the main objective of preparing them for a final project.

Description

The following topics are discussed: Network properties: (Density, size, average degree, average path length, diameter, clustering coefficient, connectivity, centrality, influence, etc.), Network models: Random graphs (Erdos-Renyi) , small worlds (Watts-Strogats), preferential attachment (Barabasi-Albert), time graphs, Network analysis: Social network analysis, dynamic network analysis, link analysis, robustness analysis, pandemic analysis (duration of infection , recovery times,…), web link analyzes (page ranking,…), centrality measurements,…, Analysis tools: spectral analysis for complex networks, measurement tools (Gamma tool), Dissemination of content in a network (SIR model): analysis of dissemination phenomena, communities,…, Interdependent networks (degrees of correlation,…).

Person(s) in charge
DHAOU RIADH

Bibliography

Network Science, by Albert-László Barabási, March 2016

· Subject Projet Ingénierie de Réseaux

Pre-requisites

Internet, Local Area Networks, Network performance

Objectives

Understand and observe the main mechanisms contributing to the implementation of quality of service in the Internet.

Description

First we address the issues related to the deployment of QoS by simulation. After a brief description of QoS architectures (IntServ, DiffServ) and QoS mechanisms: classification, measurement, smoothing, policing, scheduler, ... We study TCP congestion control mechanisms (Reno, New Reno, Tahoe) . We illustrate the most classic tools: Leaky / Token Bucket, Round Robin, Deficit Round Robin, FQ, WFQ, RED, We observe the performance of some of these mechanisms through simulations in the NS2 environment. Then we move on to setting up in a Linux / Cisco environment. The students are divided into three projects: IP level QoS, Ethernet level QoS and Load sharing (application, network and link level). The tools used: network configuration tools under linux and under Cisco. Use of hardware, software specific to networks.

Person(s) in charge
DHAOU RIADH

· Teaching Unit SYSTEMES, APPLICATIONS MOBILES ET SECURITE

Description

At the end of this UE, the student knows about the stakes at play, the methods and the best practices tailored for systems, security and mobiles application programming ; he knows the major mechanisms underlying these technologies and is able to leverage this knowledge to design and evaluate secured applications for fixed or mobile systems.

The first class introduces the core principles of operating systems (file, process, memory management). The student gets as well the basics in multithread programming.

The second class is dedicated to mobile application design. Labs and project programs are developed for Android systems. The project's aim is to have an application that enables 2 mobile devices to exchange data over a wireless interface (e.g. Bluetooth, WiFi).

The last class presents the basics of security for computer systems (definitions, problems and risks) focusing specially on network security.

Person(s) in charge
JAFFRES-RUNSER KATIA

Bibliography

Systèmes d'exploitation, Andrew Tanenbaum, 2008, Edition Pearson

Android Developer https://developer.android.com/develop/index.html

· Subject Système d'Exploitation

Person(s) in charge
ERMONT JEROME

· Subject Programmation de Mobiles

Pre-requisites

Systèmes d'exploitation

Technologies Objet

Applications concurrentes et communicantes

Conception et programmation avancée

Objectives

Know how to design and program a mobile app that enables two mobile terminals to exchange data through a wireless network interface.

Targeted skills

Define and implement Android activities and services,

Define and implement processing in tasks,

Implement message passing between tasks and activities via handlers,

Implement a communication socket

Description

This class presents the main elements to start programming Android applications. The core concepts of activities, services, intents, asynchronous tasks and handlers are presented, and manipulated in labs. A projet validates these concepts by asking students to write an app that has two phones exchange data directly through a wireless network technology.

Number of hours
1CM, 2TP and one project of 10 sessions volume (only 3 are supervised).

Person(s) in charge
JAFFRES-RUNSER KATIA

· Subject Sécurité

Pre-requisites
* C and assembly programming
* TCP/IP stack and Ethernet datalink
* Complexity, arithmetics and algebra basics

Objectives

General awareness regarding systems and network cybersecurity concerns.

Targeted skills

Implement common network security architectures thanks to linux + netfilter and iptables.

Configure a confidential and authenticated network link thanks to IPSec + IKE and linux setkeys + racoon.

Develop a baremetal shellcode for modern GNU/linux applications.

Description

Cybersecurity is a broad topic which covers a large amount of scientific domains. In terms of threat model and forensic experience, the attacker is using anytime the weakest point of attack surface to defeat the system defenses. Therefore, we propose to cover in this class a wide number of security concerns in order to teach the essential level of knowledge required to avoid most of modern systems and network vulnerabilities.

Targeted general skills and essential background :

* Being able to deploy, develop or configure systems and networks with the required security level.
* Understand the purpose of intrusion tolerant network architectures.
* Understand and use basic coding rules in order to avoid most common software vulnerabilities.
* Understand the purpose of main cryptographic primitives, their security model and the limitations in which they have been designed.

Number of hours
15 slots

Teaching method
En présence

Teaching language
French

· Teaching Unit IDM ET DEVELOPPMENT WEB

Pre-requisites

- UML

- Java

Objectives

- Understand and apply model driven engineering

Person(s) in charge
MAURAN PHILIPPE

· Subject Application Web

Objectives

Present the principles and basic technologies in the area of web applications, allowing the construction of dynamic web sites

Description

- formats and protocoles of the web

- dynamic web pages (servlets, JSP)

- Enterprise Java Bean (EJB, MVC)

- persistence layers (JDBC, JPA)

- JavaScript frameworks (Angular, Jquery)

Person(s) in charge
HAGIMONT DANIEL

· Subject Base de données

Person(s) in charge
OSTERMANN PASCAL

· Subject IDM

Pre-requisites

- UML

- Java

Objectives

- Introduction to model driven engineering

- Understand and apply the building of DSLs through abstract level

- Setting models at different abstraction levels and this is with respect to OMG standardisation

- Transformation from model to code and vis versa

- Understanding both DSMLs and DSLs

Description

- Eclipse EMF

- Abstract semantics with Ecole langage

- Static semantics with Complete OCL

- Textual syntaxe with Xtext

- Graphical syntaxe with Sirius

- Model transformation via Acceleo and Java

Person(s) in charge
OUEDERNI MERIEM

Teaching method
A distance

Teaching language
Français

Bibliography

- Gamma, Erich; Richard Helm, Ralph Johnson, and John Vlissides (1995). Design Patterns : Elements of Reusable Object-Oriented Software. Addison-Wesley. ISBN 0-201-63361-2.

- Mark Grand. Patterns in Java: A Catalog of Reusable Design Patterns Illustrated with UML, volume 1. Wiley, 2 edition, 2002.

- Sommerville, Ian (2007) [1982]. Software Engineering (8th ed.). Harlow, England : Pearson Education. ISBN 0-321-31379-8

- Model-Driven Software Development : Technology, Engineering, Management (Wiley Software Patterns Series) Thomas Stahl, Markus Voelter, ISBN

0-470-02570-0.

- EMF: Eclipse Modeling Framework 2.0 2nd, David Steinberg, Frank Budinsky, Marcelo Paternostro, Ed Merks, Addison-Wesley Professional, 2009 ISBN:0321331885.

· Teaching Unit INTERCONNEXION ET MODELISATION DES RESEAUX

Person(s) in charge
DHAOU RIADH

· Subject Evaluation de Perfomance

Pre-requisites

Graph Theory, Probability, Statistics, Computer and Telecommunications Networks

Objectives

The objectives of this course are to provide students with the tools necessary to analyze the quantitative performance of networks.

Markov chains (discrete time and continuous time), simple queues and queueing networks will be described.

Numerous examples of computer and telecommunications networks will illustrate the methods.

Person(s) in charge
BEYLOT ANDRE LUC

Bibliography

Queueing Systems, Leonard Kleinrock, Vol 1 et 2, John Wiley

· Subject Simulation de Réseaux

Objectives

This teaching provides elements for choosing the right simulation tool for the performance problem studied. It also raises the questions of validation of simulation results.

Description

First, simple discrete event simulations of queuing networks allowing on the one hand to present and use simulation tools and on the other hand to make students aware of the calculation of confidence intervals and validation of the simulation results. Then, performance studies are carried out with discrete event simulations of network protocols and resource allocation algorithms (random access methods, routing in ad-hoc mobile networks and impact on transport performance, allocation frequencies in mobile networks, rate adaptation in a wireless network) and Monte-Carlo simulations of the load control mechanism of a discretized Aloha type random access). The tools used: Network Simulator (ns-2 and ns-3), Matlab / Simulink.

Person(s) in charge
DHAOU RIADH

· Subject Interconnexion

Person(s) in charge
BEYLOT ANDRE LUC

· Teaching Unit SYSTEMES DE TELECOM SANS FIL ET MOBILES 2

Objectives

This teaching unit focuses on cellular networks (GSM, LTE, UMTS), wireless local networks (WiFi, Bluetooth), the emerging paradigm of the Internet of Things as well as some of the key physical layer technologies.

Targeted skills

By the end of the teaching unit, the students will be able to assess the physical layer of wireless and mobile systems as well as be capable of designing protocols and architectures for advanced mobile and wireless networks.

Person(s) in charge
JAKLLARI GENTIAN

Teaching method
En présence

Teaching language
French and English

Bibliography

Xavier Lagrange, Philippe Godlewski, Sami Tabbane, Réseaux GSM, Editions Hermès Science (5ème édition), Paris 2000

Xavier Lagrange, Principes et évolutions de l'UMTS, Hermès, Paris 2005

· Subject Réseaux Mobiles

Pre-requisites

Long Distance Networks, Telephone Operator Networks, Local Area Network Architecture

Objectives

The objective of this course is to describe the operation of mobile networks through their evolution. The architectures are described successively through the telecom standards 2G (GSM, GPRS/EDGE), 3G (UMTS, HS(D)PA) and 4G (LTE).

Targeted skills

Design and deploy a mobile network architecture.

Description

Program :

- Introduction: positioning of the different standards

- ITU-T networks: 2G (GSM, GPRS/EDGE), 3G (UMTS, HS(D)PA) and 4G (LTE)

Person(s) in charge
BEYLOT ANDRE LUC

· Subject Réseaux Sans-Fil

Pre-requisites

A good understanding of the TPC/IP. Some basic notions of the wireless physical layer.

Objectives

An in-depth understanding of the key challanges involved in designing protocols for wireless networks. A good understanding of the architectural differences between different wireless technologies.

Targeted skills

Be capable of designing and implementing a wireless network based on a set of requirements stemming from particular user and application needs.

Description

This course presents the main challenges related to the design and implementation of wireless networks and how they are addressed in some of the major technologies in the market, in particular WiFi and Bluetooth.

Person(s) in charge
JAKLLARI GENTIAN

Teaching method
En présence

Teaching language
English

Bibliography

[1] Computer Networking: A Top-Down Approach (7th Edition), by James Kurose, Keith Ross

[2] Mobile Communications (2nd Edition) by Jochen Schiller

· Subject Couches Physique

Pre-requisites

Students must have completed the courses on digital communications, equalization, CDMA, OFDM, channel coding and channel modeling.

Objectives

At the end of the module, the student will propose new transmission techniques for a telecommunications system.

Person(s) in charge
ESCRIG BENOIT

Bibliography

Telecommunications system standards

· Subject Projet de Réseaux Sans Fil

Person(s) in charge
DHAOU RIADH

· Semestre 8 SN FISE Parcours Systèmes de Télécommunications

Person(s) in charge
POULLIAT CHARLY

· Teaching Unit Soft and Human Skills

Person(s) in charge
HULL ALEXANDRA

· Subject Professional English 2.2 : Debates

Pre-requisites

None

Objectives

Perform key oral and written workplace tasks in English.

Targeted skills

1) Develop interactional communication and argumentation skills by actively participating in debates in English.

2) Write an reaction paper effectively in English.

3) Present your professional project convincingly during a job interview in English.

Description

A semester of 12 interactive weekly sessions to develop English intercultural communication competencies for professional purposes.

Number of hours
21 hours

Person(s) in charge
LAKE PETER

Teaching method
En présence

Teaching language
English

Bibliography
* *Heinrichs, J. (2017). Thank you for arguing: What Aristotle, Lincoln, and Homer Simpson can teach us about the art of persuasion.* Three Rivers Press (CA).
* Turabian, K. L. (2010). *Student's guide to writing college papers*. University of Chicago Press.
* Kelley, T. (2017). *Get That Job!: The Quick and Complete Guide to a Winning Interview.* Plovercrest Press.

· Second language

Person(s) in charge
BLANCO ANDRE

Choice: 1 Among 1 :

· Subject Spanish

· Subject Spanish

· Subject Chinese

· Subject Italian

· Subject Japanese

· Subject Russian

· Subject German

· Subject french (as a foreign language)

· Subject Sports

· Subject Leadership & Management

Person(s) in charge
HULL ALEXANDRA

· Choix d'UE-2ASN-S8-Parcours T

Choice: 1 Among 1 :

· Teaching Unit OPTIMISATION ET APPRENTISSAGE

Objectives

The objective of this course is to give an overview of the methods and formal tools related to the design of adaptive and/or distributed algorithms, as well as to the optimization of the parameters of a telecommunication system or in networks, generally using a learning function of the system state.

In this context, several points will be addressed:

1/Adaptive and distributed algorithms: LMS/RLS algorithms, stochastic gradient based methods. Application to adaptive signal processing and sensor networks.

2/Optimization for telecommunications: nonlinear programming with constraints, convex programming, dynamic programming, heuristic methods: application to resource allocation and scheduling;

3/Detection, Classification and Learning: blind detection, classification principles in telecommunications, neural learning methods, reinforcement learning and decision markov processes.

4/Modeling

Person(s) in charge
POULLIAT CHARLY

Bibliography

VHDL - langage, modélisation, synthèse (R. AIRIAU et al. - Presses Polytechniques et Universitaires Romandes)

· Subject Algorithmes adaptifs et distribués

Person(s) in charge
POULLIAT CHARLY

· Subject Optimisation pour les Télécommunications

Person(s) in charge
DHAOU RIADH

· Subject Détection, Classification et Apprentissage

Person(s) in charge
POULLIAT CHARLY

· Subject Modélisation de Réseaux

Person(s) in charge
DHAOU RIADH

· Teaching Unit PROJET PERSONNEL

Pre-requisites

No pre-requisite.

Objectives

This modulus consists in a project whose subject is given by a company, and which is conducted in collaboration with engineers of that company. The work is mainly done at school, but meetings and working visits can also take place in the company premises.

The main objective consists then, before the summer internship, in better understanding the way a concrete project is addressed and what specific constraints can occur in the workplace.

Targeted skills

The main skill consists in acquiring a professional approach of the implementation of a technical project.

There is no specific technical skill since the subject of the project is at choice (to define with the company) in the fields of the Sciences du Numérique diploma, which may correspond to very wide range of competences.

Description

Students, by groups of 2 or 3, have to find a company and a project subject of their choice.

To that end, they are assisted by the responsible of this modulus.

They can choose a subjected allowing them to further investigate a field of the option Communications Systems (e.g. a subject on error-correcting codes for satellite communications, with a industrial of that field), or at the contrary they can choose a subject that they will not particularly study in this option, and which will allow them to spread the spectrum of their skills (for instance, a subject on AI in a concrete case-study, or a subject on embedded systems using Arduino coding).

Person(s) in charge
COULON MARTIAL

· Subject Projet Personnel

Pre-requisites

No pre-requisite.

Objectives

This modulus consists in a project whose subject is given by a company, and which is conducted in collaboration with engineers of that company. The work is mainly done at school, but meetings and working visits can also take place in the company premises.

The main objective consists then, before the summer internship, in better understanding the way a concrete project is addressed and what specific constraints can occur in the workplace.

Targeted skills

The main skill consists in acquiring a professional approach of the implementation of a technical project.

There is no specific technical skill since the subject of the project is at choice (to define with the company) in the fields of the Sciences du Numérique diploma, which may correspond to very wide range of competences.

Description

Students, by groups of 2 or 3, have to find a company and a project subject of their choice.

To that end, they are assisted by the responsible of this modulus.

They can choose a subjected allowing them to further investigate a field of the option Communications Systems (e.g. a subject on error-correcting codes for satellite communications, with a industrial of that field), or at the contrary they can choose a subject that they will not particularly study in this option, and which will allow them to spread the spectrum of their skills (for instance, a subject on AI in a concrete case-study, or a subject on embedded systems using Arduino coding).

Person(s) in charge
COULON MARTIAL

· Teaching Unit RECEPTEURS NUMERIQUES AVANCEES

Description

The first part of this teaching unit is dedicated to technics used to design telecommunication digital receivers: multirate digital receivers, digital filter banks, synchronization algorithms. These techniques will be used in the design of a DVB receiver. The second part of this teaching unit is dedicated to spread spectrum systems (CDMA, UWB, CSS): dimensioning, performances, associated receiver.

Person(s) in charge
BOUCHERET MARIE LAURE

Bibliography

- “Multirate Systems And Filter Banks”, P. P. Vaidyanathan, Prentice Hall

- “Synchronization Techniques for Digital Receivers”, Umberto Mengali, Aldo N. D’Andrea, Springer

- “Spread Spectrum Systems for GNSS and Wireless Communications”, Jack K. Holmes, Artech House 2007

- “Principles of Spread-Spectrum Communication Systems”, Don Torrieri, 4th ed. 2018 Edition, Spinger

· Subject Bancs de filtres

Person(s) in charge
BOUCHERET MARIE LAURE

· Subject Conception de Récepteur

Person(s) in charge
BOUCHERET MARIE LAURE

· Subject Syst.èmes à Etalement de Spectre

Person(s) in charge
BOUCHERET MARIE LAURE

· Subject Projet

Person(s) in charge
BOUCHERET MARIE LAURE

· Teaching Unit SYSTEME NUMERIQUE DE TRAITEMENT DE L'INFORMATION

Objectives

The aim of this course is to present the main digital processors in use in the telecommunication industry. A first part will be dedicated to the study of FPGA processeurs and their programming using the VHDL language.

The second part will be dedicated to specific processors like DSP or GPU processors, while introducing algorithm design methodologies for hardware implementation.

Person(s) in charge
GUIVARCH RONAN
ERMONT JEROME

Bibliography

VHDL - langage, modélisation, synthèse (R. AIRIAU et al. - Presses Polytechniques et Universitaires Romandes)

· Subject FPGA : Architecture et Programmation

Pre-requisites

Basic Computer Architecture

Objectives

This course is dedicated to the presentation of what is an FPGA digital processor, as well as the VHDL language which allows to develop a circuit which will be then programmed/instantiated on the FPGA digital processor.

Targeted skills

- to know a hardware description language

- to know how to describe the functioning of an electronic component in the form of a state machine

- to have notions on the adequacy algorithm / hardware

Description

- presentation of an FPGA (principles, specificities, example of use)

- presentation of the VHDL language (syntax, specificity of a hardware description language)

- implementation of basic components (methodology, state machine modeling)

- a project around a communication protocol

Person(s) in charge
GUIVARCH RONAN

Bibliography

VHDL - langage, modélisation, synthèse (R. AIRIAU et al. - Presses Polytechniques et Universitaires Romandes)

· Subject Architectures de TraitemT de l'Infomat° dédiées, Introduct°

Person(s) in charge
ERMONT JEROME

· Teaching Unit SYSTEMES DE TELECOM SANS FIL ET MOBILES 1

Objectives

This teaching unit focus on 2G and 3G mobile networks architectures (GSM, GPRS, UMTS).

The main objectives consist on understanding the successive architectures which have been proposed and their evolution.

By the end of the teaching unit, the students will be able to assess the physical layers of 2G and 3G communication systems.

Person(s) in charge
ESCRIG BENOIT

Bibliography

Xavier Lagrange, Philippe Godlewski, Sami Tabbane, Réseaux GSM, Editions Hermès Science (5ème édition), Paris 2000

Xavier Lagrange, Principes et évolutions de l'UMTS, Hermès, Paris 2005

· Subject Réseaux Mobiles

Pre-requisites

Long Distance Networks, Telephone Operator Networks, Local Area Network Architecture

Objectives

The objective of this course is to describe the operation of mobile networks through their evolution. The architectures are described successively through the telecom standards 2G (GSM, GPRS/EDGE), 3G (UMTS, HS(D)PA) and 4G (LTE).

Targeted skills

Design and deploy a mobile network architecture.

Description

Program :

- Introduction: positioning of the different standards

- ITU-T networks: 2G (GSM, GPRS/EDGE), 3G (UMTS, HS(D)PA) and 4G (LTE)

Person(s) in charge
BEYLOT ANDRE LUC

· Subject Réseaux Sans-Fil

Pre-requisites

A good understanding of the TPC/IP. Some basic notions of the wireless physical layer.

Objectives

An in-depth understanding of the key challanges involved in designing protocols for wireless networks. A good understanding of the architectural differences between different wireless technologies.

Targeted skills

Be capable of designing and implementing a wireless network based on a set of requirements stemming from particular user and application needs.

Description

This course presents the main challenges related to the design and implementation of wireless networks and how they are addressed in some of the major technologies in the market, in particular WiFi and Bluetooth.

Person(s) in charge
JAKLLARI GENTIAN

Teaching method
En présence

Teaching language
English

Bibliography

[1] Computer Networking: A Top-Down Approach (7th Edition), by James Kurose, Keith Ross

[2] Mobile Communications (2nd Edition) by Jochen Schiller

· Subject Couches Physique

Pre-requisites

Students must have completed the courses on digital communications, equalization, CDMA, OFDM, channel coding and channel modeling.

Objectives

At the end of the module, the student will propose new transmission techniques for a telecommunications system.

Person(s) in charge
ESCRIG BENOIT

Bibliography

Telecommunications system standards

· Teaching Unit SYSTEMES, APPLICATIONS MOBILES ET SECURITE

Description

At the end of this UE, the student knows about the stakes at play, the methods and the best practices tailored for systems, security and mobiles application programming ; he knows the major mechanisms underlying these technologies and is able to leverage this knowledge to design and evaluate secured applications for fixed or mobile systems.

The first class introduces the core principles of operating systems (file, process, memory management). The student gets as well the basics in multithread programming.

The second class is dedicated to mobile application design. Labs and project programs are developed for Android systems. The project’s aim is to have an application that enables 2 mobile devices to exchange data over a wireless interface (e.g. Bluetooth, WiFi).

The last class presents the basics of security for computer systems (definitions, problems and risks) focusing specially on network security.

Person(s) in charge
JAFFRES-RUNSER KATIA

Bibliography

Systèmes d’exploitation, Andrew Tanenbaum, 2008, Edition Pearson

Android Developer https://developer.android.com/develop/index.html

· Subject Système d'Exploitation

Person(s) in charge
ERMONT JEROME

· Subject Programmation de Mobiles

Pre-requisites

Systèmes d’exploitation

Technologies Objet

Applications concurrentes et communicantes

Conception et programmation avancée

Objectives

Know how to design and program a mobile app that enables two mobile terminals to exchange data through a wireless network interface.

Targeted skills

Define and implement Android activities and services,

Define and implement processing in tasks,

Implement message passing between tasks and activities via handlers,

Implement a communication socket

Description

This class presents the main elements to start programming Android applications. The core concepts of activities, services, intents, asynchronous tasks and handlers are presented, and manipulated in labs. A projet validates these concepts by asking students to write an app that has two phones exchange data directly through a wireless network technology.

Number of hours
1CM, 2TP and one project of 10 sessions volume (only 3 are supervised).

Person(s) in charge
JAFFRES-RUNSER KATIA

· Subject Sécurité

Pre-requisites
* C and assembly programming
* TCP/IP stack and Ethernet datalink
* Complexity, arithmetics and algebra basics

Objectives

General awareness regarding systems and network cybersecurity concerns.

Targeted skills

Implement common network security architectures thanks to linux + netfilter and iptables.

Configure a confidential and authenticated network link thanks to IPSec + IKE and linux setkeys + racoon.

Develop a baremetal shellcode for modern GNU/linux applications.

Description

Cybersecurity is a broad topic which covers a large amount of scientific domains. In terms of threat model and forensic experience, the attacker is using anytime the weakest point of attack surface to defeat the system defenses. Therefore, we propose to cover in this class a wide number of security concerns in order to teach the essential level of knowledge required to avoid most of modern systems and network vulnerabilities.

Targeted general skills and essential background :

* Being able to deploy, develop or configure systems and networks with the required security level.
* Understand the purpose of intrusion tolerant network architectures.
* Understand and use basic coding rules in order to avoid most common software vulnerabilities.
* Understand the purpose of main cryptographic primitives, their security model and the limitations in which they have been designed.

Number of hours
15 slots

Teaching method
En présence

Teaching language
French

· Semestre 8 à l'Etranger

Choice: 1 Among 1 :

· Teaching Unit Semestre d'Etudes à la TU-Darmstadt (Allemagne)

· Teaching Unit Semestre d'Etudes à l'Université de Hong Kong

· Teaching Unit Sem TU-Delft (Pays-Bas)

· Teaching Unit Semestre d'Etudes Queensland U.T. (Australie)

· Teaching Unit Semestre d'étude à l'université de LEUVEN-KU (Belgique)

· Teaching Unit Semestre d'étude à l'Univ.VAASA (Finlande)

· Teaching Unit Semestre d'études Université de Cordoba (Argentine)

· Teaching Unit Sem. d'études Polytechnic Inst, Ho Chi Minh Ville (Vietnam)

· Teaching Unit Semestre d'étude Pontifica Javeriana, Bogota (Colombie)

· Teaching Unit Semestre d'études Louvain (Univ. Cath) (Belgique)

· Teaching Unit Semestre d'Etudes INHA, Incheon, Corée du Sud

· Teaching Unit Semestre d'Etudes Universidad Nacional de Columbia (UNAL)

· Teaching Unit Semestre à l'Université d'Uppsala (Suède)

· Teaching Unit Sem. Univ.Libre Bruxelles

· Teaching Unit Semestre d'Etudes à l'Université de Lima (Pérou)

· Teaching Unit Semestre d'Etudes à l'Université de Karlsruhe (Allemagne)

· Teaching Unit Semestre d'Etude à l'Université de Hamburg (Allemagne)

· Teaching Unit Semestre d'Etudes à l'Université de La Paz (Bolivie)

· Teaching Unit Semestre d'Etudes à Ecole Polytechnique de Montréal (Canada)

· Teaching Unit Semestre d'Etudes à l'Université de Stavanger (Norvège)

· Teaching Unit Semestre d'Etudes à l'Université de Trondheim (Norvège)

· Teaching Unit Semestre à la TU-Berlin (Allemagne)

· Teaching Unit Semestre d'Etudes à l'Imperial College de Londres (GB)

· Teaching Unit Semestre d'Etudes à l'Univ. d'Auckland (Nouvelle-Zélande)

· Teaching Unit Semestre d'Etudes à l'Univ. de Birmingham (UK)

· Teaching Unit Semestre d'Etudes à l'Univ. College Cork (Irlande)

· Teaching Unit Semestre d'Etudes à l'Univ. de Coventry (UK)

· Teaching Unit Semestre d'Etudes à l'Univ. d' Edimbourg (UK)

· Teaching Unit Semestre d'Etudes à l'EPFL, Lausanne (Suisse)

· Teaching Unit Semestre d'Etudes à la Fac. Polytech. de Mons (Belgique)

· **Teaching Unit Semestre d'Etudes à l'UFSC, Florianopolis (Brésil)**

· **Teaching Unit Semestre d'Etudes à Georgia Tech, Atlanta (USA)**

· **Teaching Unit Semestre d'Etudes à l'Univ. de Lund (Suède)**

· **Teaching Unit Semestre d'Etudes à la TU-Hambourg (Allemagne)**

· **Teaching Unit Semestre d'Etudes à l'Univ. de Madrid (Espagne)**

· **Teaching Unit Semestre d'Etudes à l'Univ. de Mondragon (Espagne)**

· **Teaching Unit Semestre d'Etudes à l'Univ. de Nottingham (UK)**

· **Teaching Unit Semestre d'Etudes à l'Univ. de Recife (Brésil)**

· **Teaching Unit Semestre d'Etudes à l'Univ. de Saragosse (Espagne)**

· **Teaching Unit Semestre d'Etudes à l'Univ. de Sydney (Australie)**

· **Teaching Unit Semestre d'Etudes à la TU-Brême**

· **Teaching Unit Semestre d'Etudes à la TU-Eindhoven (Pays-Bas)**

· **Teaching Unit Semestre d'Etudes à la TU-Münich (Allemagne)**

· **Teaching Unit Semestre d'Etudes à l'Univ. de Laval (Canada)**

· **Teaching Unit Semestre d'Etudes à l'Université de Bergen (Norvège)**

· **Teaching Unit Semestre d'Etudes à l'Univ. Complutense, Madrid (Espagne)**

· **Teaching Unit Semestre d'Etudes à l'Univ. de Pavie (Italie)**

· **Teaching Unit Semestre d'Etudes à l'Univ. Montréal (Canada)**

· **Teaching Unit Semestre d'Etudes à l'Univ. de Valence (Espagne)**

· **Teaching Unit Semestre d'Etudes à Concordia, Canada**

· **Teaching Unit Semestre d'Etudes à California Davis Univ. , USA**

· **Teaching Unit Semestre ETH Zürich, Suisse**

- **Teaching Unit Semestre Université de Stockholm, Suède**
- **Teaching Unit Semestre d'Etudes à l'Univ. de Purdue (USA)**
- **Teaching Unit Semestre d'Etudes à l'Univ. de Rio UFRJ (Brésil)**
- **Teaching Unit Semestre d'Etudes à l'Université de Concepcion (Chili)**
- **Teaching Unit Semestre d'Etudes à l'Univ. de Dublin DCU (IRL)**
- **Teaching Unit Semestre d'Etudes à l'Univ. de Sherbrooke (CAN)**
- **Teaching Unit Semestre d'Etudes à l'Univ. de Barcelone UPC (ESP)**
- **Teaching Unit Semestre d'Etudes à l'Univ. de Shanghai JTU (Chine)**
- **Teaching Unit Semestre d'Etudes à l'Université de Séville (Espagne)**
- **Teaching Unit Semestre d'Etudes à l'Université de Palerme (Italie)**
- **Teaching Unit Semestre d'Etudes à l'Université de Klagenfurt (Autriche)**
- **Teaching Unit Semestre d'Etudes à l'Université de Pampelune (ESP)**
- **Teaching Unit Semestre d'Etudes à la DTU Copenhague**
- **Teaching Unit Semestre d'Etudes à l'Université d'Arequipa (Pérou)**
- **Teaching Unit Semestre d'Etudes à l'Université de Belfast (GB)**
- **Teaching Unit Semestre d'Etudes à l'ETSEIB Barcelone (Espagne)**
- **Teaching Unit Sem Université de Florence**
- **Teaching Unit Sem EHTP Casablanca (Maroc)**
- **Teaching Unit Sem Univ. Aachen**
- **Teaching Unit Sem Université Stuttgart**
- **Teaching Unit Semestre d'études à l'Université de Cranfield**
- **Teaching Unit Semestre d'étudues au Royal Holoway London**

· **Teaching Unit Sem Aalborg**

· **Teaching Unit Sem St Andrews**

· **Teaching Unit Semestre d'études au Polytec. Turin**

· **Teaching Unit Semestre d'Etudes à l'Université de Chalmers (Suède)**

· **Teaching Unit Semestre d'Etudes à l'Univ. de Cracovie**

· **Teaching Unit Semestre d'Etudes à la Wrije Univ. Bruxelles**

· **Teaching Unit Semestre d'Etudes à l'Univ. de Guadalajara (Mexique)**

· **Teaching Unit Semestre d'Etudes à l'Univ. de Chengdu (Chine)**

· **Teaching Unit Semestre d'Etudes à l'Univ. de Bahia Blanca (Argentine)**

· **Teaching Unit Semestre d'Etudes Erasmus Mundus IMETE**

· **Teaching Unit Semestre d'Etudes Univ. d'Oxford**

· **Teaching Unit Semestre d'études Université de Tomsk, Russie**

· **Teaching Unit Semestre d'études Université de Buenos Aires**

· **Teaching Unit Semestre d'études UPB Bucarest**

· **Teaching Unit Semestre d'Etudes à l'Université de Sonara (Mexique)**

· **Teaching Unit Sem Université Wuhan HUST, Chine**

· **Teaching Unit Sem Université Delhi DTU**

· **Teaching Unit Sem Université de Gdansk, Pologne**

· **Teaching Unit Sem USTH, Hanoï**

· **Teaching Unit Sem Univ. Rome Tor Vergata**

· **Teaching Unit Sem Université Nationale Taïwan**

· **Teaching Unit Sem ETS Montréal**

- **Teaching Unit Sem Université Varsovie**
- **Teaching Unit Semestre d'Etudes à Narvik University College (Norvège)**
- **Teaching Unit Semestre d'Etudes à l'Université de Twente (Pays-Bas)**
- **Teaching Unit Semestre d'études à l'univ. du Pays Basque Bilbao (ESP)**
- **Teaching Unit Sem Technicka Univerzita v Liberci, Liberec, Rép. Tchèque**
- **Teaching Unit Semestre d'Etudes à l'Université de Manchester**
- **Teaching Unit Semestre d'Etudes Université de Chicoutimi, Canada**
- **Teaching Unit Semestre d'Etude à l'Univ. Valparaiso, Chili**
- **Teaching Unit Semestre d'Etudes Séoul National University**
- **Teaching Unit Sem Firenze-UDSDF-Italie**
- **Teaching Unit Sem Constance (Allemagne)**
- **Teaching Unit Semestre à Bologne (Italie)**
- **Teaching Unit Semestre d'Etudes à l'Université d'Amsterdam**

· Semestre 8 - Hors N7en France

Choice: 1 Among 1 :

- **Teaching Unit Semestre d'étude à l'ESC Toulouse**
- **Teaching Unit Semestre IAE Toulouse**
- **Teaching Unit Semestre ESC Rouen**
- **Teaching Unit Semestre EMLyon**
- **Teaching Unit Semestre d'Etudes à l'ISAE**
- **Teaching Unit Semestre d'Etudes à l'ENSIMAG**
- **Teaching Unit Semestre d'étude à Paris 6 Jussieu**

- **Teaching Unit Semestre Université Paris-Dauphine**
- **Teaching Unit Semestre d'études à Télécom Management**
- **Teaching Unit Semestre d'Etudes à Centrale Nantes**
- **Teaching Unit Semestre d'Etudes à l'Ecole Navale, Brest**
- **Teaching Unit Semestre d'études à Sciences Po Paris**
- **Teaching Unit Semestre d'études à Télécom Sud Paris**
- **Teaching Unit Semestre d'étude à Eurecom**
- **Teaching Unit Semestre d'études Toulouse Business School**
- **Teaching Unit Semestre Supelec**
- **Teaching Unit Semestre IFP**
- **Teaching Unit Semestre d'études à l'Université de Montpellier**
- **Teaching Unit Semestre d'études à l'ESSEC**
- **Teaching Unit Semestre ENAC**
- **Teaching Unit Semestre IAE Paris**
- **Teaching Unit Semestre IAE Lyon**
- **Teaching Unit Semestre d'études à l'ENSPM**
- **Teaching Unit Semestre à l'Ecole Polytechnique, Palayseau**
- **Teaching Unit Semestre d'Etudes à l'ENSAE**
- **Teaching Unit Université Paris-Saclay**
- **Teaching Unit Semestre d'études à l'ENM**
- **Teaching Unit Semestre d'études à l'ENSE3**
- **Teaching Unit Semestre d'études à l'ENSTA**

· **Teaching Unit Semestre d'études à HEC Paris**

· **Teaching Unit Semestre A7 Génie des Systèmes Industriels**

· **Teaching Unit Semestre INSTN**

· **Nombre de semaines Stage 1ère Année**

· **Mobilité 1ère Année FISE-FISA**

Organizational unit

École Nationale Supérieure d'Électrotechnique d'Électronique d'Informatique d'Hydraulique et des Télécommunications

Ingénieur ENSEEIHT Informatique et Télécommunications 3ème année

MORE INFO

ECTS credits : 60

Organization

- **Année 3A Informatique et Télécommunication (SN)**

Organizational unit

École Nationale Supérieure d'Électrotechnique d'Électronique d'Informatique d'Hydraulique et des Télécommunications