INGÉNIEUR ENSEEIHT MÉCANIQUE ET GÉNIE HYDRAULIQUE

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

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 d'études 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 "Mécanique et Génie Hydraulique" est un ingénieur de haut niveau technique et scientifique par la formation qu'il a suivie dans les domaines de la mécanique des fluides, de la combustion, de l'hydrologie, incluant la modélisation numérique et le calcul intensif.

Grace au socle commun de formation, l'ingénieur INP-ENSSEEIHT "Mécanique et Génie Hydraulique" :

- Maitrise les concepts et principes de la mécanique des fluides.

- Maitrise les systèmes thermodynamiques et les mécanismes de transferts.

- Maitrise les principes de base de la mécanique des solides et des structures.

- Maitrise les systèmes à fluides.

- Maitrise les méthodes numériques et le calcul scientifique haute performance.

- Maitrise les techniques d'instrumentation et de mesure utilisées en mécanique et mécanique des fluides.

-Conçoit, dimensionne et modélise des systèmes pour l'énergie, le transport et les procédés.

-Conçoit, dimensionne et modélise des systèmes liés à des problématiques environnementales, naturelles et climatiques.

-Identifie, développe et valide des algorithmes pour la simulation numérique haute performance en mécanique des fluides.

-Conçoit, développe et caractérise des systèmes de contrôle pour la régulation et la commande de dispositifs hydrauliques et énergétiques, et pour le développement des systèmes nomades et embarqués.

-Modélise des problèmes de mécanique multi-échelles et/ou multi-physiques et/ou stochastiques.

Compétences détaillées :

-Identifier les régimes d'écoulements afin de proposer une modélisation adaptée d'un problème mettant en jeu des écoulements en mécanique des fluides générale et/ou en aérodynamique

-Appréhender les modèles physiques, la représentation des écoulements à tout régime pour optimiser des systèmes mécaniques complexes en mobilisant de manière croisée les concepts de l'aérodynamique, de la physique et du calcul numérique

-Identifier, sélectionner et analyser avec esprit critique des données issues d'expérimentations in situ ou de laboratoire ou de simulations numériques afin de représenter un phénomène multi-physique ou physique environnemental

-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

-Analyser et modéliser les écoulements atmosphériques à toute échelle en réponse à une problématique environnementale

-Appréhender la modélisation, la représentation des écoulements à surface libre et souterrains afin de prévoir des aménagements ou de répondre à des enjeux sociétaux

-Mobiliser les concepts fondamentaux de la mécanique dans un but de conception, de dimensionnement et de maintenance d'ouvrages

-Analyser, contrôler et modéliser le fonctionnement des ouvrages hydrauliques afin de les gérer dans le respect des contraintes réglementaires et environnementales

-Choisir et mettre en oeuvre des modèles permettant d'appréhender des situations naturelles complexes dans un monde en transition

-Expliquer les phénomènes multiphysiques mis en jeu dans un système complexe et multi-échelle en mobilisant les concepts fondamentaux de l'énergétique

-Choisir et mettre en oeuvre des modèles afin de simuler le fonctionnement de systèmes énergétiques et multiphasiques afin de les caractériser et de les optimiser

-Identifier, sélectionner, représenter et analyser avec esprit critique des données issues d'expérimentations in situ ou de laboratoire ou de simulations numériques afin de représenter un phénomène physique en énergétique

-Mobiliser les concepts fondamentaux du calcul scientifique pour mettre en équation des phénomènes physiques en mécanique des fluides et adapter les méthodes de résolution

-Interpréter les résultats d'une simulation afin de critiquer les modèles pour améliorer et critiquer le système physique et sa représentation

-Utiliser les concepts de l'IA pour développer des modèles évolués permettant de traiter des problèmes physiques plus efficacement

-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 Mécanique et Génie Hydraulique 1ère année
Ingénieur ENSEEIHT Mécanique et Génie Hydraulique 2ème année
Ingénieur ENSEEIHT Mécanique et Génie Hydraulique 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 70 dans la spécialisation Mécanique et Génie Hydraulique.

3.3.1 La majorité des étudiants recrutés en première année (79% 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 (13% 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 (8% 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

Ingénieur ENSEEIHT Mécanique et Génie Hydraulique 1ère année

MORE INFO

ECTS credits : 60

Organization

· Année-1A Mécanique-GH FISE

· Semestre 5-1A Méca-GH-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 Mathematics 1

· Subject Integration

Objectives

The purpose of the course is to become acquainted with the Lebesgue integral and the use of the theory of integration, as it is involved in the tools for signal processing regarding integral transforms. The concept of distribution is also introduced as it is essential fo the generalization of basic operations as derivation, convolution or Fourier transform.

Targeted skills

Be able to assess measurability and integrability of a given function.

Be able to apply convergence theorems and Leibniz integral rule.

Be able to use distributions, in particular in the resolution of Ordinary Differential Equations.

Be able to find Fourier and Laplace transforms, and to interpret them in the frame of signal processing.

Description

Measure theory.

Measurable function, simple function integration.

Convergence theorems, Leibniz integral rule.

Lp spaces.

Distribution, derivation and convolution.

Fourier and Laplace transforms.

Person(s) in charge
BERGEZ WLADIMIR

Teaching method
En présence

Teaching language
French

Bibliography

Walter Rudin, Real and Complex Analysis, 3rd ed., Mc Graw Hill, 1987.

Laurent Schwartz, Méthodes mathématiques pour les sciences physiques, Hermann, 1965.

Walter Appel, Mathématiques pour la physique et les physiciens, 5ème ed., H&K, 2017.

Terence Tao, An introduction to measure theory, 2011.

· Subject Probabilities

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
7 lectures of 1h45 and 5 exercice sessions of 1h45

Person(s) in charge
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TOURNERET JEAN-YVES

Teaching method
En présence

Teaching language
Français

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

· Teaching Unit Computer science 1 - Basics of algorithms, programming and computer architecture

Pre-requisites

None

Objectives

Write a computing program to solve a problem of mecanics or physics, using basic algorithms and programming in a linux environment.

· Subject Applied Informatics: Systems, Tools, Architectures

Objectives

Present the computer resources available at the ENSEEIHT while performing a student upgrade on mastering the tools and understanding how they work.

Description
1 . Presentation of office automation tools (word processor and spreadsheet).
2 . Introduction to the architecture of computers.
3 . Concepts and properties of an operating system.
4 . Initiation to Unix: file system, main commands, shells.
5 . From the program to the process (interpreted languages, compiled languages, compilers, link editing, execution).

Person(s) in charge
HAMROUNI ZOUHAIER

· Subject Analysis and Programming method : Algorithmics

Pre-requisites

None

Objectives

Develop a methodology so that a physicist can write a computer program using algorithmic and programming.

Description

- Decomposition method of a simple program: sequence, loop.

- Definition of input data, output data and functionality of a program.

- Introduction of a main program, subroutine and file.

Translation into the Fortran 90 language.

Person(s) in charge
BONOMETTI Thomas
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BONOMETTI THOMAS

Bibliography

Delannoy, C. (1997). *Programmer en Fortran 90: guide complet*. Eyrolles.

· Teaching Unit Fluid Mechanics 1

Objectives

At the end of this teaching unit, first-year engineering students will be able to:

* to describe a set of applications of fluid mechanics
* to produce a dimensional analysis from a physical model
* to explain the physical meaning of the different terms of the fluid mechanics equations
* to use the tools of algebra to manipulate the equations of fluid mechanics
* to generate analytical solutions of the Lamé and Navier-Stokes equations

Description

The topics covered in this teaching unit are:

* Dimensional analysis.
* Mass, momentum or energy budgets
* Understanding of the terms of the constitutive equations for elastic and fluids mechanics.
* Analytical solutions of the Navier-Stokes
* Coupling between thermodynamics and compressible fluids.

The assessment is composed as follows:

* Three written exams (1:45 each): 75%
* Three Practical Work (4h each): 25%

The 1h45 pedagogical sequences are distributed as follows:

* 15 Magistrates Courses
* 13 Tutorials
* 1 Pratical case study
* 2 Inverted classes

Person(s) in charge
THUAL Olivier
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· Subject Introduction to Fluid Mechanics

Objectives

This course precedes the "continuum mechanics" course where the Navier-Stokes equations are derived and implemented in some academic situations presenting an accessible analytical solution. The purpose of this course is to provide a physical insight into some basic problems in fluid mechanics via dimensional analysis and analysis using orders of magnitude. It introduces dimensionless numbers and adimensionalization of an equation system. At the end of the course, students will be able to:

* to master the vocabulary used to classify the flows and physical phenomena observe.
* to produce a dimensional analysis of a physical problem.
* to make dimensionless an equation system for a physical problem.
* to explain the physical meaning of the different terms of the conservation equations and to use them to analyze with the hands a problem.

Description

1 . Illustration of classical flows and discovery of vocabulary to describe the flows and physical phenomena observed.
2 . Physical Analysis of Navier-Stokes Equations. The two viscosities. Transport mechanisms. Capillary effects.
3 . Dimension and adimensionalization of the quantities and equations. Discussion on studies in similarities
4 . The Pi / Vaschy Buckingham theorem and application for solving simple physical problems.
5 . Law of scales and problem solving by manipulation of orders of magnitude.

Two sessions of TP:

TP1 in wind tunnel for implementation of the concepts of aerodynamic forces and coefficient of drag and lift. Study of similarity

TP2: Reynolds experiment. Flow regime, laminar / turbulent, pressure drop. Taylor-Couette flow transitions.

Person(s) in charge

LEGENDRE DOMINIQUE

· Subject Continuum mechanics

Objectives

This course allows to assimilate the basic formalism of the mechanics of the continuous environments leading to the writing of the Lamé and Navier-Stokes equations.

At the end of the first part of the course, freshmen will be able to:

* to use the formalism of the linear algebra to follow the demonstrations leading to the equations of the mechanics of the continuous mediums;
* explain the transformations between volumes and surfaces in the balance equations;
* describe behavioral laws for the diffusion of heat or the rheology of elastic solids;
* calculate analytical solutions for simple linear elasticity problems.

At the end of the second part of the course, freshmen will be able:

* to describe the kinematics of the flows using matrices expressing the rotation or the deformation of the particles;
* to formulate the conservation equations of mass, momentum and energy;
* to describe behavioral laws for the Newtonian fluid rheology;
* to calculate analytical solutions for simple fluid mechanics problems.

Description

1) Linear algebra and tensors: Einstein convention, differential operators, the divergence formula

2) The continuum hypothesis: heat flux vector by small tetrahedra, Fourier law and state law leading to the heat equation.

3) Large and small deformations: Jacobian matrice, dilatation tensor and small strains tensor, Jacobian.

4) Stress tensor under small strains: mass conservation in Lagrangian representation, fundamental principle of dynamics, existence and symmetry of the stress tensor.

5) Lamé equations : Hooke's Law, longitudinal and transverse waves in solids.

6) Kinematics: trajectories, streamlines, particle spin.

7) Transport theorems: rotation vector and tensor strain rate, pass on a moving domain.

8) incompressible Navier-Stokes equations: fundamental principle of the dynamics, law of behavior.

9) Compressible Navier-Stokes equations: "theorem" of kinetic energy and power of internal forces, first principle of thermodynamics.

A session of Practical Work (4h): "Hydraulic jump", to illustrate the notion of discontinuity and jump relation.

Number of hours
Presential 50 h + Personal work 25 h = 75 h

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THUAL OLIVIER

Teaching method
En présence

Bibliography

[1] O. Thual, Mécanique des Milieux Continus, *Éd. Ress. Pédago. Ouv. INP* **1018** (2012) 48h

[2] Introduction à la Mécanique des milieux continus déformables - Auteur : O. THUAL - Editeur : Cépaduès - Editions , 1997 - ISBN : 2854284550

URL : http://www.cepadues.com/chercher.asp?rapid=thual

[3] Étagère de cours Scholarvox : Mécanique des milieux continus

· Teaching Unit Fluid Mechanics 2

· Subject Thermodynamics

Objectives

Learning of the first and second law of thermodynamics in order to apply them on classical installations (turbine, compressor, heat exchangers, motors,...)

Description

This course begins with the basis of thermodynamics with the two first laws, the state equation formulation, the use of thermodynamical potentials, models of simple system, phase change and air humidity

Teaching method
En présence

· Teaching Unit Mechanics 1

· Subject Rational Mechanics

Objectives

General training in mechanics necessary for the continuation of the various courses in Hydraulics - Fluid Mechanics. Assimilation of concepts, analysis and applications of principles, learning methods of analysis and resolution of mechanical systems for the engineer.

Description

1 . Consolidation of achievements: Referentials, velocities, accelerations, kinetic forces and magnitudes, general theorems.
2 . Rigid solids: Rigid motion, matrix of inertia, specialization of general theorems, primary integrals of the movement, contact between solids, bonds.
3 . Small oscillations: harmonic oscillator, equilibrium, linearization of small movements, eigen modes, resonance, beats, linear stability analysis of mechanical systems.

· Subject Linear Elasticity

Objectives

The aim of the course is to propose a short introduction to linear elasticity. The student must become familiar with the use of stress and strain tensors. The resolution of plane elasticity problems by Airy function is presented and stress field solutions of simple geometries are established (bending of a beam, torsion of a circular bar, plate with a hole, cylindrical container under pressure, gravity dam…).

Targeted skills

- Be able to calculate, measure and analyze a deformation.

- Be able to calculate, measure and analyze a stress.

- Be able to determine maximum values of normal and tangential stress.

- Be able to address an elasticity problem with stress or displacement formulation.

- Be able to find the solutions of plane elasticity with Airy complex or real function.

Description

1. Infinitesimal strain.

2. Stress tensor.

3. Constitutive law of linear elasticity of an isotropic homogeneous media (Hooke law).

4. Displacement and stress formulations : Navier/Lamé and Beltrami-Michell equations.

5. Plane elasticity.

Teaching method
En présence

Teaching language
French

· Choix de Parcours1A Méc-GH-FISE

Choice: 1 Among 1 :

· Sem. 6 CESURE

· Semestre 6-N7-1A Mécanique-GH 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.

· ELP à Choix

Choice: 1 Among 1 :

· Teaching Unit Hydraulic Engineering

· Subject Integral Balances

Pre-requisites

Introduction to fluid mechanics

Continuum mechanics

Mathematical tools for fluid mechanics

Objectives

Establish integral balance equations governing the dynamic of homogeneous fluids

Targeted skills

These balance equations allow calculating the effort on a profile using the Euler theorem or the evolution of the pressure or the velocity in a flow using the different Bernoulli theorems.

Description

Application of the principles of Newtonian mechanics and thermodynamics

Person(s) in charge
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Teaching method
En présence

Teaching language
French

Bibliography

Chassaing, P. 2000. Mécanique des fluides - Éléments d'un premier parcours. Toulouse, France : Cépaduès Éditions.

Chapter 3

Prerequisites : chapters 1 and 2

· Subject Hydraulics : Learning By Project

Objectives

External link towards the pitch of the course

It's about being able to calculate pressure losses in a hydraulic network by reading a Moody diagram or by developing an ad hoc digital program. The calculation of quantities related to a hydraulic jump is a second objective. Finally, the establishment of links between hydraulics and fluid mechanics is an integral part of this teaching.

This teaching combines several educational formulas:

* Traditional Transmissive Education (ETT): Teachers expose knowledge through lectures and tutorials.
* Project Apprenticeship (APP): the realization of projects motivates a search for useful information, independently.
* Progress in Groups (PEG): An individual course work is followed by group discussions and collaborations.

Description

The hydraulics in charge processes pressurized flows in closed conduits. Free surface hydraulics treat flows in open channels. The essential notions are:

* Hydraulic load
* Linear load losses
* Singular charge losses

Hydraulic machines refer to pumps as well as turbines. The essential notions are:

* The three types of pumps
* Load balance and yields
* Operating parameters

Person(s) in charge

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ROIG Veronique
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DURU Paul
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Phone 2877

CASSAN LUDOVIC

Bibliography

* Olivier Thual, Hydraulique pour l'ingénieur généraliste, Cépaduès-Éditions 2018
* Olivier Thual, Hydraulique pour l'ingénieur généraliste, *Éd. Ress. Pédago. Ouv. INP* **0714** (2018) 16h
* Saad BENNIS, Hydraulique et hydrologie, Presse de l'Université de Québec, 2009. Chapitres 2, 3, 5 et 6. Accès ScholarVox
* Frank M. WHITE, Fluid mechanics, 7th Edition in SI Units, *McGraw-Hill*, 2011. Chapitres 6, 10 et 11
* Bruce R. MUNSON, Theodore H. OKIISHI, Wade W. HUEBSCH and Alric P. ROTHMAYER, Fondamentals of Fluid mechanics, 7th Edition SI Version, *Wiley,* 2013. Chapitres 8, 10 et12. La 6ème édition est téléchargeable sur (Engineering Study Material)

· Teaching Unit DECOUVERTE EN MECANIQUE DES FLUIDES

Person(s) in charge
ALBAGNAC JULIE

· Subject Introduction au vol

Person(s) in charge
AIRIAU CHRISTOPHE

· Subject Energies renouvelables

Person(s) in charge
TANGUY SÉBASTIEN

· Teaching Unit Mathematics 2

· Subject Finite Differences

Objectives

At the end of this course, the student must be able to propose a relevant discretization for a linear PDE using the finite difference method and to analyze the convergence (consistency and stability) and accuracy.

Description

The finite difference method is first introduced for the discretization of the model equations (advection equation and diffusion equation). Convergence (consistency and stability) and precision analysis techniques are discussed using the Lax theorem and the matrix method. These analysis tools are then used to choose discretization schemes adapted to each of the linear EDP families. The analysis of the error committed (diffusion, dispersion) is finally introduced.

Person(s) in charge
LEGENDRE DOMINIQUE

· Subject Statistics

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 and 3 practical sessions of 1h45

Person(s) in charge
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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.

· Subject Introduction to optimization

Objectives

Learn the basics of optimization methods: decision variables, objective function, minimization of nonlinear problems, least squares problems, minimization under stress

numerical optimization approach: iterative gradient methods; least squares problems; other numerical methods such as simulated annealing; network / graph problems

Targeted skills

- be able to pose an optimization problem with or without constraint

- be able to use solvers (Matlab, Python ...) to solve minimization problems, linear / nonlinear regression type, Newton's method ...

- be able to apply functional minimization and Euler-Lagrange equations for simple systems

Description

1. Free and constrained minimization, Lagrange multipliers, convexity

2. Application 1: Nonlinear Regression, Model Registration,

3. Application 2: Newton's method for finding equilibrium points

4. Functional optimization

5. Application: minimal surfaces

Person(s) in charge
BERGEZ VLADIMIR

· Teaching Unit Signal Processing & Control systems

· Subject Signal and Automatic

Objectives

The objective is to acquire tools of the engineer in deterministic signal processing and automatic continuous time, for a first approach of the main aspects related to the mechanical vibrations in an industrial context: the modeling, the measurement, the control. Localized parameter modeling (lumped parameters) is preferred.

Description

The module consists of two parts:

I Modal Experimental Analysis (4 CM, 6TD, 1TP):

- SLI Model Linear Invariant System

- Introduction to the concepts of organization and interaction.

- Frequency Response Function (F.R.F).

- Oscillatory and aperiodic mode. Stability.

- Convolution property. Memory effect.

- Filtering (RII, RIF).

- Introduction to the signal concept (Fourier analysis)

- Digital identification techniques

- Consequences of temporal truncation (spectral leakage, resolution)

- Time Sampling Effects (Spectral Folding, Shannon's Th.)

- Discrete TF (reciprocal Shannon th)

- TP Modal Experimental Analysis: Modal identification (impact hammer) and detection of defects of a rotating machine (real-time monitoring by Simulink RTW, problem of starting and stopping machine). Resonance and anti-resonance of a 2 ddl system.

II APP Vibrations Under Control (project by team)

- Through Project Based Learning, students acquire basic concepts and knowledge to control a hydromechanical process. The teaching team (5 tutors, one expert) has defined the following learning objectives:

- The concept of system to represent a physical process.

- Knowing how to translate the organization (the natural or artificial interactions) of a system by a recursive functional diagram (looped).

- To be able to translate the phenomena of his specialty, by associations of elementary models: Inertial effect, Resistive, Capacitive.

- Identify a basic hydromechanical process by analyzing the response to a deterministic solicitation (behavior model)

- Linearize a nonlinear model around an operating point to obtain a model L.T.I. (Linear Invariant System) in transfer.

- Determine the stability of a system controlled by the Nyquist criterion.

- Understand the risks of looped architecture (influence of phase delays on stability).

- Understand the interest of the looped architecture for performance (for stability, to manage disturbances).

- Know how to adapt a Proportional controller taking into account the antagonisms between performances (stability / precision, speed / sensitivity to noise). An "agile coach" accompanies teams for project management (SCRUM method).

Person(s) in charge
HARRAN GILLES

· Teaching Unit Fluid Mechanics 3

· Subject Flow at large Reynolds

Objectives

To assimilate the formalism of the potential flows with the aim of introducing bases for the Reynolds large flow modeling and in particular for aerodynamics. An introduction to the dynamics of vorticity is also proposed.

Description

-Superposition of potential flows.

-Efforts exerted by a potential flow on an obstacle (formulas of Blasius). D'Alembert's paradox, Joukowsky's theorem.

-Condition of Kutta.

-Method of the conformal transformation to obtain the lift of a wing profile (example of the transformation of Zhukovsky).

-Basic notion of swirling dynamics.

This teaching will be divided n into 5 Courses and 6 TDs.

Person(s) in charge
MOUGEL JEROME

· Subject Low Reynolds Flows

Pre-requisites

Méca Fluides 1

Objectives

The object of this course is to describe the particular hydrodynamic phenomena that one encounters with small Reynolds numbers . The basic equations are commented, analyzed and solved in simple geometries.

Targeted skills

Ability to design, size and model systems for energy, transportation and processes.

Ability to design, develop and characterize control systems for the regulation and control of hydraulic and energy devices and for the development of nomadic and embedded systems.

Ability to model multi-scale and / or multi-physics and / or stochastic mechanical problems

Description

Introduction: Re << 1 What is inertia? and applications

Basic equations and different formulations

Specific properties (linearity, reversibility, reciprocity) and consequences.

Fundamental Solutions of Stokes Equations

Cellule of Hele-Shaw

Lubrication (hydraulic bearing)

Flows in thin layers

Calculation of the stokes force

Number of hours
12,25

Person(s) in charge
TORDJEMAN PHILIPPE

Teaching method
En présence

Teaching language
french

Bibliography

Hydrodynamique physique Guyon, Hulin Petit

· Subject Bubbles, Drops and Particles

Description

I. Bubbles, drops and particles (5 class sessions, 2 TD sessions)

1) Introduction: Industrial and Environmental Issues bubbles drops and particles of energetics and processes to the environment.

2) The different types of particles. Nature of the particle vs condition surface (notion of surfactant) Structure of flow and wake / production of vorticity Shape effect (deformability of fluid particles: spherical, ellipsoidal, foolish) => limitation of course.

3) Terminal speed (<=> The drag) for each case: solution with the hands (physical arguments) then analytical solution.

3a) Stokes Law: Viscous regime

3b) Newton's law: inertial regime

3c) Levich's Law (Dissipation of Viscous Lead Flow)

4) Mass added Kinetic energy, impulse, drift

5) Trajectory

5a) Maxey decomposition

5b) Archimedes generalized

5c) Relaxation time

5d) Number of Stokes Rq: a number of dynamic effects (to be defined) will have to be left out (and will be seen in 3H). For example, history, lift, magnus.

Person(s) in charge
LEGENDRE DOMINIQUE

· Teaching Unit Hydraulic Engineering

· Subject Numerical Methods - Finished Volumes

Objectives

Understand the fundamental concepts of the Finished Volumes approach. Knowing how to pass from a physical problem continues to its discretized form in finite volumes.

Description

Introductions to the Finite Volumes method. The principle of the method is introduced and the steps of the implementation are detailed on the basis of simple examples (convection / diffusion equation) in order to allow easy passage to the coding. The Associate Design Office sessions consist of the development of a program written in FORTRAN language and operated on a microcomputer.

Person(s) in charge
STOUKOV ALEXEI

· Subject Numerical Laminar Simulations - FLUENT Software

Pre-requisites

Basic Fluid mechanics course

Basis in scientific computing

Objectives

Present the structure of a generalist fluid mechanics code.

Give a method in order to decompose a physical problem.

Interpret and criticize the results of the code.

Description

Presentation of the structure of the generalist codes of fluid mechanics. - Learn to ask and then break down a physical problem. - Introduce this decomposition in an industrial calculation code (Fluent at present). - Interpret and critique the results of the code on various classic examples of the first-year fluid mechanics course.

Number of hours
17.5

Person(s) in charge
DEBENEST GERALD

Teaching method
En présence

Teaching language
French

Organizational unit

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

Ingénieur ENSEEIHT Mécanique et Génie Hydraulique 2ème année

MORE INFO

ECTS credits : 60

Organization

· Année 2A Méc-GH FISE

· Choix de Parcours S7-2A-Mécanique-GH FISE

Choice: 1 Among 1 :

· Sem 7 MF2E Parc. Programme Insertion Méthodologique (PIM)

· Choix d'UE Scientifique-MF2E

Choice: 3 Among 3 :

####### · Teaching Unit MECANIQUE DES FLUIDES 4

######## · Subject Complex Fluids

Pre-requisites

Continuous medium mechanics

Meca Fluides 1

Objectives

Knowing and mastering the key concepts of Complex Fluids.

Targeted skills

Ability to design, size and model systems for energy, transportation and processes.

Ability to model multi-scale and / or multi-physics and / or stochastic mechanical problems.

Description

1 / Introduction- examples of applications 5 major types of complex fluids: thixoptropic, antithixotropic, pseudoplastic, dilatant, threshhold Effect of the difference of normal stresses: Weissemberg effect, ... Examples, applications, relation with the microstructure, formulation of industrial fluids and environmental fluids. Notion of relaxation time, phase transition, glass transition, compatible and incompatible mixtures

2 / PhenomenologyThe mechanical analog models: Kelvin, Maxwell, Burger, ...Kelvin generalized, Maxwell generalized

3 / Entropic elasticity. Rubber elasticity, Langevin's equation

4 / Mechanics of complex fluids. Behavioral laws and momentum conservation equation: objectivity, Reiner-Rivlin fluids, generalized Newtonian fluids, pseudoplastic fluids (plug flow), Eulerian elasticity notion, corotational and convected Maxwell models (Oldroyd-B), single integral models (Lodge, Wagner, ..)

5 / Molecular models Rouse model (polymer in solution) Fractality and self - similar behavior - modeling6 / Experimental rheology. Rheometries plan-plan, cone-plan, Couette, capillary, elongational

Number of hours
17,5

Person(s) in charge
TORDJEMAN PHILIPPE

Teaching method
En présence

Teaching language
french

Bibliography

Rhéophysique P Oswald (Belin)

· Subject Boundary Layers, Jet and laminar wakes

Objectives

Presentation of asymptotic calculation methods (perfect fluid, boundary layers) and analytical resolution of simple problems in laminar flow. Analysis of wall transfers (momentum, heat flow, mass transfer)

Description

Reminders about the perfect fluid flows.

Dynamic, massic and thermal laminar boundary layers

- Localization of viscous effects in real fluid flows with large Reynolds number: advection-diffusion report

- Characteristic parameters of the boundary layers: thicknesses, wall transfers

- Local equations of the isovolume dynamic boundary layer: Prandtl model

- detachments

- Integral equations and global balances in evolution isovolume: von Karman equations Methods and examples for calculating boundary layer flows

- Resolution of local equations

- Calculation by integral method: von Karman-Polhausen equations

- Examples of calculations: flat plate, impacting jet

Title Associated TP (s): Limit layer on flat plate at ENSICA

· Teaching Unit MECANIQUE DES FLUIDES 5

Person(s) in charge
ZAMANSKY RÉMI

· Subject Turbulent Flows Introduction

Pre-requisites

- Basis on Mechanics of continuous media and fluid mechanics (notion of constraints, Navier-Stokes equations)

- Concepts of statistics and signal processing (moment, correlation, spectrum, distribution function)

Objectives

- Presentation of classical methods of treatment and resolution of turbulent flows

- Introduction of the concept of turbulent viscosity and the associated assumptions and limitations

- Application to cases of canonical turbulent flow (jet, boundary layer ...)

- Phenomenological introduction of turbulent field statistics (multi-point time statistics) and aspects of dispersion and mixing by turbulent flows

- Opening on the different numerical simulation strategies of turbulent flows.

Targeted skills

- Estimation of the characteristic scales of a turbulent flow

- Understanding of turbulent viscosity models

- Understanding the notions of separation of scales

- Understanding of the notions of self-similarity

Description

- 9 courses

- 6 TD

- 2 TP computer

- 2 experimental labs

- 1 exam

Introduction to turbulent flow

1- Introduction

2- derivation of Reynolds equations

3- Free shear flows (jets, wakes, layer of mixtures)

4- Wall flows (boundary layers, pipes)

5- Turbulent mixing and natural convection

6- Structure of the turbulence

Person(s) in charge
ZAMANSKY RÉMI

Bibliography

[1] H. Tennekes et J. L. Lumley : A First Course in Turbulence. MIT Press, 1972.

[2] É. Guyon, J.-P. Hulin et L. Petit : Hydrodynamique physique. EDP Sciences, 3e édition édition, 2012.

[3] P. Chassaing : Turbulence en mécanique des fluides. Cépaudès-éditions, Collection POLYTECH, 2000.

[4] S. B. Pope : Turbulent Flows. Cambridge University Press, 2000.

[5] P. Davidson : Turbulence : An Introduction for Scientists and Engineers. OUP Oxford, 2004.

[6] J. Mathieu et J. Scott : An Introduction to Turbulent Flow. Cambridge, 2000.

· Subject Introduction to instabilities

Objectives

The course objectives are:

- Explore the simple mathematical tools to determine if an equilibrium is stable or unstable.

- Understand the physical understanding of fluid flows through the study of their instabilities.

Description

- Kelvin-Helmholtz Instability

- Rayleigh-Benard instability

- Linearization around equilibrium

Person(s) in charge
THUAL OLIVIER

Bibliography

[1] P. BERGE, Y. POMEAU, C. VIDAL, L'ordre dans le chaos, Hermann, 1984.

[2] S. CHANDRASEKHAR, Hydrodynamic and hydromagnetic stability, Clarendon Press, 1981.

[3] F. CHARRU, Instabilités hydrodynamiques, EDP Sciences, 2007.

[4] P. G. DRAZIN, W. H. REID, Hydrodynamic Stability, Cambridge University Press, 2nd Edition, 2004.

[5] E. GUYON, J.-P. HULIN, L. PETIT, Hydrodynamique physique, EDP Sciences, nouvelle 2ditions, 2001.

[6] O. THUAL, Des ondes et des fluides, Cépaduès-Éditions, 2005.

[7] O. THUAL, Hydrodynamique de l'environnement, Éditions de l'École Polytechnique, 2010.

[8] O. THUAL, Pédagothèque Dynamique, http://thual.perso.enseeiht.fr/otices

[9] http://moodle-n7.inp-toulouse.fr/course/view.php?id=350

· Teaching Unit MECANIQUE 2

Person(s) in charge
MOUGEL JEROME

· Subject Wave dynamics

Pre-requisites

Fluid mechanics skills in the first year of a Fluid Mechanics Department

Objectives

At the end of lectures and tutorials on the dynamics of strained string vibrations, sound waves, surface waves and elastic waves, students in this course will be able to:

* quickly produce the linearized version of a model,
* accurately illustrate the oscillations of the physical fields,
* quickly apply the method of solving the wave equation,
* generate with hindsight calculations of coefficients of reflection and transmission,
* generate without error the dispersion relation of the waves,
* systematically compare their phase and group speeds,
* explain the phenomenon of wave packets,
* describe qualitatively the impulse response of a medium.
* read and assimilate a significant part of the concepts and developments of a reference book on the subject, in English.

Click here to see the video

Targeted skills
* To know and master the concepts and principles of fluid mechanics.
* To know and master the basic principles of solid mechanics and structures.
* Ability to design, size and model systems for energy, transportation and processes.
* Ability to model multi-scale and / or multi-physics and / or stochastic mechanical problems.
* Mastery of methods and tools of the engineer and a wide disciplinary field

Description
Lectures and tutorials

The following chapters of the book of reference (wave motion) are discussed in the following order:

7. Formation and propagation of shock waves

1. Basic Concepts

2. Waves along a string with tension

3. Sound Waves

4. Linear surface waves

5. Waves in an elastic solid

The oral presentation will highlight the generality of the concepts studied and will be given an important place in understanding the calculations presented in the book in order to properly assimilate. Digital artwork will be developed.

Project on the serious game "Car Traffic"
* Link to the car traffic simulator
* Link to the associated pedagogical numerical resource

Objectives: At the end of the project on the dynamics of this road traffic model, the students of this course will be able to apply the method of the characteristics to calculate the evolution of a density of cars in the presence of small disturbances or important disturbances like the alternation of a traffic light.

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MOUGEL Jerome
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Phone 2830

THUAL OLIVIER

Bibliography
* J. BILLINGHAM and A.C. KING - Editeur : Cambridge University Press , 2006 - ISBN : 9780521634502
* J.-F. PARMENTIER et O. THUAL, Modèle de trafic routier et caractéristiques, Éd. Ress. Pédago. Ouv. INPT 1013 (2012) 6h
* Étagère du cours ScholarVox : Dynamique des ondes

· Subject Introduction to structure mechanics

Objectives

Introduce the basic concepts for dealing with a structural mechanics problem. At the end of this course, students will be able to deal with the static and dynamic problems of a structure subjected to loading as well as the problems of buckling of a structure.

Description

-Geometry of the beams and introduction of the torsor.

-Normal effort.

-Moment of flexion.

- Shearing effort.

-Energy methods (Castigiano's theorem, Menabréa's theorem, fictitious load method, Maxwell-Betti's theorem).

-Modeling of the buckling of a structure.

-Dynamic structures (Rayleigh method, Ritz method, introduction to finite element method).

This teaching will be broken down into 8 courses and 10 tutorials.

Person(s) in charge

MOUGEL JEROME

· Teaching Unit CALCUL SCIENTIFIQUE 2

Pre-requisites

- Notions in the numerical analysis of partial differential equations.

- Notions programming (python, C, fortran, etc)

- Notions regarding the finite volume method

Objectives

Perform numerical simulations for fluid mechanics problems via:

- the use of Computational Fluid Dynamics codes

- developing numerical softwares solving 2 dimensional Partial Differential Equations.

Person(s) in charge
BONOMETTI THOMAS

· Subject Advanced use of CFD codes

Pre-requisites

Knowledge in fluid mechanics

previous use of CFD codes is preferable

Objectives

Present the structure of a generalist fluid mechanics code. Interpret the results of the code by providing critical expertise based on the achievements of second year fluid mechanics courses

Description

Illustration of the second year fluid mechanics course.

Interpret and critique the results of the code on different classical examples: Turbulent flow in a tube, and mini-project on an advanced case

Person(s) in charge
DEBENEST GERALD

Teaching method
En présence

Teaching language
Français

Bibliography

- See Moodle site

· Subject Numerical Methods for PDE

Pre-requisites

- Notions in the numerical analysis of partial differential equations.

- Notions programming (python, C, fortran, etc)

- Notions regarding the finite volume method

Objectives

- Introduction to the methods of resolution of linear systems applied to numerical methods for solving a partial differential equation (PDE).

- From an existing code solving a 2D advection-diffusion PDE (language: Fortran 90, explicit scheme), modify it in order to use implicit scheme.

Description

Teaching (2 classes):

- Explicit/implicit scheme, finite-volume method

- Introduction to direct/iterative methods for solving linear systems

Project (8 classes):

- getting use to the explicit code

- writing of the implicit scheme

- implementation and exploitation of the implicit scheme

Person(s) in charge
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Thomas.Bonometti@imft.fr
Phone 2952

BONOMETTI THOMAS

· Subject Stochastic Processes

Person(s) in charge
BERGEZ VLADIMIR

· Teaching Unit TRANSFERTS

Person(s) in charge
BERGEZ VLADIMIR

· Subject Heat and Mass Exchange

Objectives

This course introduces the three main mechanisms of heat transfer (conduction, convection and radiation). The course focuses on basic methods to estimate heat flux and temperature magnitude in systems as well as industrial or natural. The program follows the book Fundamental of Heat and Mass Transfer, Bergman et al..

Targeted skills

- be able to calculate a heat flux or a thermal resistance in steady-state conduction.

- Be able to use empirical correlations to calculate heat transfer coefficient for external or internal incompressible flow, or in free convection.

- Be able to address spectral and angular quantities in radiation process (intensity, emissive power, irradiation, radiosity…)

- Be able to calculate radiation exchange between diffuse grey surfaces.

Description

1. Introduction : the three modes of heat transfer, energy balance, examples.

2. Heat conduction : steady-state conduction in 1 and 2 dimensions, transient conduction.

3. Convection : forced convection, external and internal flows, free convection, conservation equations, boundary layers and empirical method.

4. Radiation : radiation concept, black body, surface effects, radiation exchange between surfaces.

5. Experimental works : infrared thermography, heat conduction coefficient and thermal diffusivity measures.

Person(s) in charge
BERGEZ VLADIMIR

Teaching method
En présence

Teaching language
French with english book

Bibliography

T.L. Bergman, A.S. Lavine, F.P. Incoprera, D.P. Dewitt, Fundamentals of Heat and Mass Transfer, J. Wiley

· Subject Transfers in porous media

Pre-requisites

Basic knowledge in fluid mechanics

Objectives

The basics about porous media are presented.

The understanding of moisture displacements in porous media under the effect of gravity or capillarity is discussed. We will study the resolution of flow problems in a porous medium whether it is transient or permanent.

Ultimately, the student following this course will be able to model mass transport in porous media by having tackled the problem of upscaling. This teaching covers broad application areas: underground hydraulics, petroleum engineering, drying techniques, civil engineering, agriculture, etc.

It serves as a basis for 3rd year specialty courses in hydrology or multiphasic porous media.

Description

Description and characterization of the different physical structures most commonly encountered in porous media. Definition of parameters specific to their study.

Presentation of some methods for solving flows occurring in underground hydraulics (Darcy's law, free surface flows, non-permanent flows).

Mass transport in porous media: dispersion equation with illustration of solute transport, active or not, within a porous matrix.

Number of hours
15.75

Person(s) in charge
DEBENEST GERALD

Bibliography

- slides

- exercises

- documents available in the moodle platform

· 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 MF2E Parcours N7-2A-Mécanique-GH FISE

· 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 MECANIQUE DES FLUIDES 4

· Subject Complex Fluids

Pre-requisites

Continuous medium mechanics

Meca Fluides 1

Objectives

Knowing and mastering the key concepts of Complex Fluids.

Targeted skills

Ability to design, size and model systems for energy, transportation and processes.

Ability to model multi-scale and / or multi-physics and / or stochastic mechanical problems.

Description

1 / Introduction- examples of applications 5 major types of complex fluids: thixoptropic, antithixotropic, pseudoplastic, dilatant, threshhold Effect of the difference of normal stresses: Weissemberg effect, ... Examples, applications, relation with the microstructure, formulation of industrial fluids and environmental fluids. Notion of relaxation time, phase transition, glass transition, compatible and incompatible mixtures

2 / PhenomenologyThe mechanical analog models: Kelvin, Maxwell, Burger, ...Kelvin generalized, Maxwell generalized

3 / Entropic elasticity. Rubber elasticity, Langevin's equation

4 / Mechanics of complex fluids. Behavioral laws and momentum conservation equation: objectivity, Reiner-Rivlin fluids, generalized Newtonian fluids, pseudoplastic fluids (plug flow), Eulerian elasticity notion, corotational and convected Maxwell models (Oldroyd-B), single integral models (Lodge, Wagner, ..)

5 / Molecular models Rouse model (polymer in solution) Fractality and self - similar behavior - modeling6 / Experimental rheology. Rheometries plan-plan, cone-plan, Couette, capillary, elongational

Number of hours
17,5

Person(s) in charge
TORDJEMAN PHILIPPE

Teaching method
En présence

Teaching language
french

Bibliography

Rhéophysique P Oswald (Belin)

· Subject Boundary Layers, Jet and laminar wakes

Objectives

Presentation of asymptotic calculation methods (perfect fluid, boundary layers) and analytical resolution of simple problems in laminar flow. Analysis of wall transfers (momentum, heat flow, mass transfer)

Description

Reminders about the perfect fluid flows.

Dynamic, massic and thermal laminar boundary layers

- Localization of viscous effects in real fluid flows with large Reynolds number: advection-diffusion report

- Characteristic parameters of the boundary layers: thicknesses, wall transfers

- Local equations of the isovolume dynamic boundary layer: Prandtl model

- detachments

- Integral equations and global balances in evolution isovolume: von Karman equations Methods and examples for calculating boundary layer flows

- Resolution of local equations

- Calculation by integral method: von Karman-Polhausen equations

- Examples of calculations: flat plate, impacting jet

Title Associated TP (s): Limit layer on flat plate at ENSICA

· Teaching Unit MECANIQUE DES FLUIDES 5

Person(s) in charge
ZAMANSKY RÉMI

· Subject Turbulent Flows Introduction

Pre-requisites

- Basis on Mechanics of continuous media and fluid mechanics (notion of constraints, Navier-Stokes equations)

- Concepts of statistics and signal processing (moment, correlation, spectrum, distribution function)

Objectives

- Presentation of classical methods of treatment and resolution of turbulent flows

- Introduction of the concept of turbulent viscosity and the associated assumptions and limitations

- Application to cases of canonical turbulent flow (jet, boundary layer ...)

- Phenomenological introduction of turbulent field statistics (multi-point time statistics) and aspects of dispersion and mixing by turbulent flows

- Opening on the different numerical simulation strategies of turbulent flows.

Targeted skills

- Estimation of the characteristic scales of a turbulent flow

- Understanding of turbulent viscosity models

- Understanding the notions of separation of scales

- Understanding of the notions of self-similarity

Description

- 9 courses

- 6 TD

- 2 TP computer

- 2 experimental labs

- 1 exam

Introduction to turbulent flow

1- Introduction

2- derivation of Reynolds equations

3- Free shear flows (jets, wakes, layer of mixtures)

4- Wall flows (boundary layers, pipes)

5- Turbulent mixing and natural convection

6- Structure of the turbulence

Person(s) in charge
ZAMANSKY RÉMI

Bibliography

[1] H. Tennekes et J. L. Lumley : A First Course in Turbulence. MIT Press, 1972.

[2] É. Guyon, J.-P. Hulin et L. Petit : Hydrodynamique physique. EDP Sciences, 3e édition édition, 2012.

[3] P. Chassaing : Turbulence en mécanique des fluides. Cépaudès-éditions, Collection POLYTECH, 2000.

[4] S. B. Pope : Turbulent Flows. Cambridge University Press, 2000.

[5] P. Davidson : Turbulence : An Introduction for Scientists and Engineers. OUP Oxford, 2004.

[6] J. Mathieu et J. Scott : An Introduction to Turbulent Flow. Cambridge, 2000.

· Subject Introduction to instabilities

Objectives

The course objectives are:

- Explore the simple mathematical tools to determine if an equilibrium is stable or unstable.

- Understand the physical understanding of fluid flows through the study of their instabilities.

Description

- Kelvin-Helmholtz Instability

- Rayleigh-Benard instability

- Linearization around equilibrium

Person(s) in charge
THUAL OLIVIER

Bibliography

[1] P. BERGE, Y. POMEAU, C. VIDAL, L'ordre dans le chaos, Hermann, 1984.

[2] S. CHANDRASEKHAR, Hydrodynamic and hydromagnetic stability, Clarendon Press, 1981.

[3] F. CHARRU, Instabilités hydrodynamiques, EDP Sciences, 2007.

[4] P. G. DRAZIN, W. H. REID, Hydrodynamic Stability, Cambridge University Press, 2nd Edition, 2004.

[5] E. GUYON, J.-P. HULIN, L. PETIT, Hydrodynamique physique, EDP Sciences, nouvelle 2ditions, 2001.

[6] O. THUAL, Des ondes et des fluides, Cépaduès-Éditions, 2005.

[7] O. THUAL, Hydrodynamique de l'environnement, Éditions de l'École Polytechnique, 2010.

[8] O. THUAL, Pédagothèque Dynamique, http://thual.perso.enseeiht.fr/otices

[9] http://moodle-n7.inp-toulouse.fr/course/view.php?id=350

· Teaching Unit MECANIQUE 2

Person(s) in charge
MOUGEL JEROME

· Subject Wave dynamics

Pre-requisites

Fluid mechanics skills in the first year of a Fluid Mechanics Department

Objectives

At the end of lectures and tutorials on the dynamics of strained string vibrations, sound waves, surface waves and elastic waves, students in this course will be able to:

* quickly produce the linearized version of a model,
* accurately illustrate the oscillations of the physical fields,
* quickly apply the method of solving the wave equation,
* generate with hindsight calculations of coefficients of reflection and transmission,
* generate without error the dispersion relation of the waves,
* systematically compare their phase and group speeds,
* explain the phenomenon of wave packets,
* describe qualitatively the impulse response of a medium.
* read and assimilate a significant part of the concepts and developments of a reference book on the subject, in English.

Click here to see the video

Targeted skills
* To know and master the concepts and principles of fluid mechanics.
* To know and master the basic principles of solid mechanics and structures.
* Ability to design, size and model systems for energy, transportation and processes.
* Ability to model multi-scale and / or multi-physics and / or stochastic mechanical problems.
* Mastery of methods and tools of the engineer and a wide disciplinary field

Description
Lectures and tutorials

The following chapters of the book of reference (wave motion) are discussed in the following order:

7. Formation and propagation of shock waves

1. Basic Concepts

2. Waves along a string with tension

3. Sound Waves

4. Linear surface waves

5. Waves in an elastic solid

The oral presentation will highlight the generality of the concepts studied and will be given an important place in understanding the calculations presented in the book in order to properly assimilate. Digital artwork will be developed.

Project on the serious game "Car Traffic"
* Link to the car traffic simulator
* Link to the associated pedagogical numerical resource

Objectives: At the end of the project on the dynamics of this road traffic model, the students of this course will be able to apply the method of the characteristics to calculate the evolution of a density of cars in the presence of small disturbances or important disturbances like the alternation of a traffic light.

Person(s) in charge
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THUAL OLIVIER

Bibliography
* J. BILLINGHAM and A.C. KING - Editeur : Cambridge University Press , 2006 - ISBN : 9780521634502
* J.-F. PARMENTIER et O. THUAL, Modèle de trafic routier et caractéristiques, Éd. Ress. Pédago. Ouv. INPT 1013 (2012) 6h
* Étagère du cours ScholarVox : Dynamique des ondes

· Subject Introduction to structure mechanics

Objectives

Introduce the basic concepts for dealing with a structural mechanics problem. At the end of this course, students will be able to deal with the static and dynamic problems of a structure subjected to loading as well as the problems of buckling of a structure.

Description

-Geometry of the beams and introduction of the torsor.

-Normal effort.

-Moment of flexion.

- Shearing effort.

-Energy methods (Castigiano's theorem, Menabréa's theorem, fictitious load method, Maxwell-Betti's theorem).

-Modeling of the buckling of a structure.

-Dynamic structures (Rayleigh method, Ritz method, introduction to finite element method).

This teaching will be broken down into 8 courses and 10 tutorials.

Person(s) in charge
MOUGEL JEROME

· Teaching Unit CALCUL SCIENTIFIQUE 2

Pre-requisites

- Notions in the numerical analysis of partial differential equations.

- Notions programming (python, C, fortran, etc)

- Notions regarding the finite volume method

Objectives

Perform numerical simulations for fluid mechanics problems via:

- the use of Computational Fluid Dynamics codes

- developing numerical softwares solving 2 dimensional Partial Differential Equations.

Person(s) in charge
BONOMETTI THOMAS

· Subject Advanced use of CFD codes

Pre-requisites

Knowledge in fluid mechanics

previous use of CFD codes is preferable

Objectives

Present the structure of a generalist fluid mechanics code. Interpret the results of the code by providing critical expertise based on the achievements of second year fluid mechanics courses

Description

Illustration of the second year fluid mechanics course.

Interpret and critique the results of the code on different classical examples: Turbulent flow in a tube, and mini-project on an advanced case

Person(s) in charge
DEBENEST GERALD

Teaching method
En présence

Teaching language
Français

Bibliography

- See Moodle site

· Subject Numerical Methods for PDE

Pre-requisites

- Notions in the numerical analysis of partial differential equations.

- Notions programming (python, C, fortran, etc)

- Notions regarding the finite volume method

Objectives

- Introduction to the methods of resolution of linear systems applied to numerical methods for solving a partial differential equation (PDE).

- From an existing code solving a 2D advection-diffusion PDE (language: Fortran 90, explicit scheme), modify it in order to use implicit scheme.

Description

Teaching (2 classes):

- Explicit/implicit scheme, finite-volume method

- Introduction to direct/iterative methods for solving linear systems

Project (8 classes):

- getting use to the explicit code

- writing of the implicit scheme

- implementation and exploitation of the implicit scheme

Person(s) in charge
BONOMETTI Thomas
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BONOMETTI THOMAS

· Subject Stochastic Processes

Person(s) in charge
BERGEZ VLADIMIR

· Teaching Unit TRANSFERTS

Person(s) in charge
BERGEZ VLADIMIR

· Subject Heat and Mass Exchange

Objectives

This course introduces the three main mechanisms of heat transfer (conduction, convection and radiation). The course focuses on basic methods to estimate heat flux and temperature magnitude in systems as well as industrial or natural. The program follows the book Fundamental of Heat and Mass Transfer, Bergman et al..

Targeted skills

- be able to calculate a heat flux or a thermal resistance in steady-state conduction.

- Be able to use empirical correlations to calculate heat transfer coefficient for external or internal incompressible flow, or in free convection.

- Be able to address spectral and angular quantities in radiation process (intensity, emissive power, irradiation, radiosity…)

- Be able to calculate radiation exchange between diffuse grey surfaces.

Description

1. Introduction : the three modes of heat transfer, energy balance, examples.

2. Heat conduction : steady-state conduction in 1 and 2 dimensions, transient conduction.

3. Convection : forced convection, external and internal flows, free convection, conservation equations, boundary layers and empirical method.

4. Radiation : radiation concept, black body, surface effects, radiation exchange between surfaces.

5. Experimental works : infrared thermography, heat conduction coefficient and thermal diffusivity measures.

Person(s) in charge
BERGEZ VLADIMIR

Teaching method
En présence

Teaching language
French with english book

Bibliography

T.L. Bergman, A.S. Lavine, F.P. Incoprera, D.P. Dewitt, Fundamentals of Heat and Mass Transfer, J. Wiley

· Subject Transfers in porous media

Pre-requisites

Basic knowledge in fluid mechanics

Objectives

The basics about porous media are presented.

The understanding of moisture displacements in porous media under the effect of gravity or capillarity is discussed. We will study the resolution of flow problems in a porous medium whether it is transient or permanent.

Ultimately, the student following this course will be able to model mass transport in porous media by having tackled the problem of upscaling. This teaching covers broad application areas: underground hydraulics, petroleum engineering, drying techniques, civil engineering, agriculture, etc.

It serves as a basis for 3rd year specialty courses in hydrology or multiphasic porous media.

Description

Description and characterization of the different physical structures most commonly encountered in porous media. Definition of parameters specific to their study.

Presentation of some methods for solving flows occurring in underground hydraulics (Darcy's law, free surface flows, non-permanent flows).

Mass transport in porous media: dispersion equation with illustration of solute transport, active or not, within a porous matrix.

Number of hours
15.75

Person(s) in charge
DEBENEST GERALD

Bibliography

- slides

- exercises

- documents available in the moodle platform

· Choix de Parcours-S8-2A-Mécanique-GH FISE

Choice: 1 Among 1 :

· Semestre 8 MF2E FISE Parcours Eau et Environnement

· 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 UE PROJET MF2E S8

Choice: 2 Among 2 :

· Teaching Unit PROJETS INIT. PERSONNEL

Objectives

The objective of this teaching unit is to implement a particular methodology (numerical or experimental) to carry out a scientific project.

The skills developed are:

* Physical analysis of the problem to be treated
* Choosing an appropriate methodology
* Implementation of this methodology (existing tools or tools to develop)
* Results analysis

Person(s) in charge
DURU PAUL

· Subject Experimental Project

Objectives

Give the students the opportunity to deepen their knowledge by carrying out a project in a small group under the guidance of an educational tutor. Allow students to acquire autonomy and sense of initiative. Introduce students to project management and teamwork.

Description

The work program depends on the subject chosen in consultation between the group of students and the tutor. It focuses on the illustration, mostly experimental, and the better understanding of physical phenomena addressed in the teachings of the department.

Person(s) in charge
DURU PAUL

· Teaching Unit PROJET NUMERIQUE

Pre-requisites

None

Objectives

- study a physical problem using or developing numerical tools

- manage a group project in semi-autonomy

Person(s) in charge
BONOMETTI THOMAS

· Subject Numerical Project

Objectives

The objective of this course (in the form of a project) is to study in small groups an environmental phenomenon of your choice based on numerical simulation tools. To do this, you will have the choice of the subject and the methodology, with two possible strong orientations: starting from an existing code / numerical simulation software to study a particular phenomenon or directly developing a numerical simulation code (solving the equations of St Venant for example).

From your choice, you will realize your group project in autonomy, with the support of the supervisors to guide you in your approach.

The objectives of this course are multiple, it will be useful both from a numerical point of view to develop your skills of coding, use and understanding of the codes used in environment, to deepen and better understand a subject in environment, and also to develop your autonomy and project management skills.

The rendering will be in the form of a website, followed by an oral presentation to share your project with the rest of the class.

Description

* Project management: autonomy, group organization, time management ...
* Coding / use of software
* Deepening of a theme of personal interest
* Writing a report, ability to analyze, critique and summarize

Person(s) in charge
BONOMETTI THOMAS

· Teaching Unit PROJET RECHERCHE

Person(s) in charge
COLIN CATHERINE

· Subject Projet Recherche

Person(s) in charge
COLIN CATHERINE

· Teaching Unit Hydrodynamics and Structures

Objectives

This UE addresses all the notions of hydrodynamics in environment necessary to a hydraulic engineer:

* the theoretical bases are given in the course of Free Surface Hydraulics,
* the 1D and 2D modeling project allows students to familiarize themselves with standard 1D and 2D free-surface flow simulation software in practical study-office type cases,
* numerical methods for free-surface flows make the link between theory and modeling by emphasizing the good conditions of use of software,

* the experimental project proposes direct applications of theoretical and numerical bases,
* the Canal Control and Irrigation course applies all of these concepts to the operational management of irrigation canals.

Person(s) in charge
ROUX HELENE

· Subject Open channel flows

Objectives

This course provides the theoretical basis of hydrodynamic environment upstream of specializing courses in open channel flow hydraulics or turbulence in rivers.

The aim is to train engineers capable of deepening the many applications of open channel hydraulics, river hydraulics, irrigation or sanitatio networks

etc.

One numerical project is included in this course :

1D flow on an obstacle

Three Laboratory Hands-on are associated to this cours:

* HO "Hydraulic jump" (RH)
* HO "Hydraulic Laval nozzle" (TLH)
* HO "Crested weir - Bottom Valve" (SV)

Description
* Open Channel Hydraulics:hydraulic load,specific loadandimplusion,backwatercurves
* Kinematic wave approximation:Navier-Stokes equationswith free surface, derivationof the equations ofSaint-Venant, floodwaves dynamics
* Swellingsandhydraulic jumps:1DSaint-Venantequations,wavesof relaxation,compression waves.

Person(s) in charge
THUAL OLIVIER

Bibliography

[1] O. THUAL, Hydrodynamique de l'environnement, Éditions de l'École Polytechnique, 2010.

· Subject 1D and 2D modeling of free surface flows

Pre-requisites

Open channel hydraulics

Objectives

Becoming familiar with a software performing one-dimensional hydraulic calculations (1D/2D Saint-Venant equations)

Targeted skills

Be able to implement a model to study open-channel flows with the right modelling hypothesis according to the available data and the study site

Description

Performing hydraulic calculations for a full network of natural and constructed channels: propagation of a flood wave, irrigation management, impact of structures, ...

Softwares:

* HEC-RAS (http://www.hec.usace.army.mil/software/hec-ras/)
* TELEMAC2D (http://www.opentelemac.org/)

Person(s) in charge
ROUX Helene
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ROUX HELENE

Teaching method
En présence

Teaching language
French

Bibliography

HEC-RAS (http://www.hec.usace.army.mil/software/hec-ras/)

TELEMAC2D (http://www.opentelemac.org/)

· Subject Numerical methods for free surface flows

Pre-requisites
* Willingness to develop free surface flow modeling skills
* Free surface hydraulics
* Scientific calculation 1 and 2

Objectives

The objective of the course is to understand the stakes and limitations of St Venant's equation solving software, such as those used by environmental engineers (eg Telemac or HECRAS). This will allow you to understand the issues involved in prescribing boundary conditions and the proper use of these programs to provide valuable expertise.

Description
* Reminders on the properties of solutions and digital difficulties encountered.
* Schemes for the equations of Saint-Venant.
* Conditions to the limits.

Person(s) in charge
MAURIN RAPHAEL

· Teaching Unit TRANSFERTS EN MILIEUX NATURELS

Objectives

This UE consists of an introduction to the transfer processes in natural environments, characterized here by the sedimentary (erosion and sediment transport) and ecological (eco-hydraulic) aspects related to watercourses, as well as by the hydrology of sub-rivers. surface (hydraulic in porous media).

Person(s) in charge
MAURIN RAPHAEL

· Subject Erosion and Solids Transport

Pre-requisites

* Fluid mechanics: forces on a particle in a flow, free surface hydraulics (flow regime, general knowledge), power of a flow.
* Curiosity
* Motivation
* Participation

Objectives

At the end of the course students will need to know :

* Identify the issues associated with sediment transport in rivers.
* Define dimensionless numbers associated with sediment transport and associated modes of transport.
* Determine the threshold of movement of a watercourse from the granulometry, the water level and the slope of the watercourse.
* Explain the mechanisms associated with the equilibrium slope of a watercourse.
* Plan the evolution of a watercourse in model situations from the mechanisms associated with the balance of a watercourse.
* Plan the evolution of a watercourse in concrete situations from the mechanisms associated with the balance of a watercourse.
* Describe the different types of watercourse and their link with their environment (mountain, plain, ..).
* Understand technical documents on the transport of sediments in rivers.
* Defend a watercourse development project by arguing on a scientific basis.
* Interact and convince an audience.
* Evaluate the work and understanding of other students.

Description

The objective of the course is to give you a first approach to sediment transport, more specifically focused on sediment transport in rivers.

Starting from the mechanisms at the particle scale, we will introduce the dimensionless sediment transport numbers to identify the main parameters and define the different transport regimes. The role of dimensionless numbers and their implications will be illustrated through concrete applications. Subsequently, we will introduce the concept of power in relation to the equilibrium slope of the watercourse. This will allow us to analyze a number of field situations and to understand the basic mechanisms of sediment transport. From there, we will also study the different forms of watercourse, from the mountain to the plain.

The rest of the course will be dedicated to the study and analysis of concrete documents written by actors from the field (engineering office, RTM, river unions ...), which will then be explained and defended orally before other students.

The teaching will be largely based on student participation, through activities, reflections and group work.

Person(s) in charge
MAURIN RAPHAEL

Bibliography

“Éléments d’hydromorphologie fluviale”, J.-R. Malavoi et J.-P. Bravard, guide Onema

http://www.onema.fr/elements-d-hydromorphologie-fluviale

“Éléments de connaissance pour la gestion du transport solide en rivière”, J.-R. Malavoi, C. C. Garnier, N. Landon, A. Recking, Ph. Baran, guide Onema

http://www.onema.fr/elements-de-connaissance-pour-la-gestion-du-transport-solide-en-riviere

“Torrents et rivières de montagne, dynamique et aménagements”, sous la direction de A. Recking, D. Richard, G. Degoutte, Quae.

Available at the N7 library.

· Subject Hydraulics in Porous Media

Objectives

Specialization of the basics of fluid mechanics and continuous media ... to the problems of porous media, with applications in underground hydraulics, hydrology of soils and groundwater, and / or in geotechnics - deformable porous media (depending on the year).

Description

Bases:

* Porous media, porosity, void ratio, dry bulk density, particle size
* Hydrostatic saturated and unsaturated porous media; water retention curve
* Hydrodynamics: from Navier-Stokes to Darcy; Darcy's law; conservation equations
* Deformable porous media: compressibility, effective stress / Terzaghi, etc.
* Review of different flow equations (local or vertically integrated)
* Recap: "Porous Media in a Nutshell".

Hydrology and environment:

* Infiltration and puddling (genesis of 'hortonian' floods)
* Exfiltration of groundwater and tablecloth-river interactions
* Groundwater drainage problems (examples in hydrology and / or civil engineering)

Civil and geotechnical engineering (depending on the year):

* Compaction, consolidation, subsidence
* Earth dikes (leak rates)
* Tunnels and underground excavations (pumping, seepage, leakage flow)

Person(s) in charge
ABABOU RACHID

Bibliography
* Physique du sol. - Auteur : A. Musy et M. Soutter - Editeur : Presses Polytech. et Univ. Romandes. Lausanne , 1991
* Hydraulique souterraine. - Auteur : G. Schneebeli - Editeur : Eyrolles , 1987
* ELEMENTS D'HYDROLOGIE SOUTERRAINE - Auteur : R.Ababou - Editeur : ENSEEIHT , 2007

URL : http://rachid.ababou.free.fr
* Dynamics of Fluids in Porous Media - Auteur : J. Bear - Editeur : Dover Publications , 1988

· Subject Eco-hydraulic

Person(s) in charge
CASSAN LUDOVIC

· Teaching Unit APP METEO, CLIMAT, RESSOURCES EN EAU

Objectives

After the courses "Meteorology and Climate" and "Water Resources", second year students will be able to:

* describe quantitatively the water volumes of the different components of the hydrological cycle;
* formulate a hydrological balance at different scales of time and space;
* interpret usual weather maps and vertical soundings of the atmosphere;
* explain the phenomenon of greenhouse effect;
* analyze the consequences of global warming.

Person(s) in charge
THUAL OLIVIER

· Subject Geostatistics and Data Processing

Objectives

Theory and applications of methods of analysis and data processing used in geosciences (land and space) and more broadly in engineering, such as:

* Sampling and estimation problems (of an average, a distribution)
* Regression methods (single, multiple)
* Problems of interpolation and extrapolation of data in space and time

Description

A. STATISTICAL BASIS:

* Distribution Function, Proba Density, Moments and Other Statistics
* Constructing an empirical F.d.R by points or histograms
* Estimation or adjustment of a model law (e.g., by the method of moments)
* Sampling: sampling uncertainty; Jack-Knife method
* Multivariate proba laws (attached, marginal, conditional: Bayes th)
* Variance-covariance matrix and correlation matrix
* Simple regression Y = aX + b (reinterpretation in terms of optimal estimation)

B. APPRENTICES - (depending on years and case studies):

* Multiple regression Y = A1.X1 + ... + Ak.Xk + b
* Bayesian estimation of state vectors / application to time signals
* Binary variables, random processes of failures, rare events Delaunay Triangulation & Voronoi Polygons
* Bayesian estimation of state vectors / application in space (x, y, z): geostatistics, kriging, co-kriging

TYPES OF METHODS

"Non-statistical" methods of data analysis

* Spatial interpolation and spatial averaging by non-statistical method
* Wavelet analyzes

TYPES OF DATA

* In time (geophysical signal processing, hydroreweather, hydrological);
* In space (methods of interpolation and geostatistical estimation).

Examples:

* Time data or "signals" (time series sampled in time
* Failures, exceeding thresholds: reliability analyzes and risk studies
* Spatial data - sampled in space (x, y, z)

TYPES OF APPLICATIONS:

The case studies are drawn from earth sciences and hydrology as well as from the junction between industrial and environmental applications (construction failures, civil engineering, mining engineering, risk studies / nuclear waste management, etc.).

Person(s) in charge
ABABOU RACHID

Bibliography

* Théorie des probabilités - Auteur : Ventsel Hélène - Editeur : Editions Mir , 1973
* Random Functions in Hydrology - Auteur : Bras R. et I.Rodriguez-Iturbe - Editeur : Dover Publications
* Probability, Random Variables, and Stochastic Processes - Auteur : Papoulis A.,S.U.Pillai - Editeur : McGrawHill , 2002
* Aide-Mémoire "Statistique et probabilités pour l'ingénieur" - Auteur : Veysseyre Renée - Editeur : Dunod , 2006

· Subject Climate PBL

Objectives

At the end of the sixteen 1h45 sessions of the Climate PBL, engineering students will be able to:

* Describe the predominant phenomena of the water cycle and atmospheric circulation
* Explain the mechanisms responsible for climate change and its impacts
* Organize a sequence of processes using conceptual diagrams
* Integrate multiple pieces of information from scientific literature
* Select key facts to explain complex scientific concepts
* Generate educational resources that can be easily used by other scientists

Description

The Table below presents the program of the 16 sessions of the “Climate PBL”. The first two sessions are grouped into a half-day for an introduction to the course, followed by training in the animation of the Climate Fresk. The last two sessions, also grouped into half a day, are devoted to "reverse lectures", during which three groups of students present a summary of the "Active Multimedia Conference" (AMC) they have constructed. Between these two half-days, the sessions combine lectures by teachers and group work workshops under the supervision of these experts.

Slots		Sequencing of sessions	LC	PD	OL	OP	HR	MB	DA	OT	Total
TD	1	Presentation of the Climate PBL and "Climate Fresk" facilitation training							1	1	2
TD	2								1	1	2
CM	3	Additional greenhouse effect							*1*	1	2
CM	4	Disruption of the water cycle					1			*1*	2
CM	5	Flooding			1						1

CM	6	Freshwater resources	1							1
CM	7	Cyclones			1					1
CM	8	Carbon Cycle (three cards in the Fresk)	1						*1*	2
CM	9	Aerosols	1					*1*		2
CM	10	Air Temperature Rise						1	*1*	2
CM	11	Ice melting (three cards in the Fresk)		1				*1*		2
CM	12	Rising water temperature		1				*1*		2
CM	13	Extreme climate events					1	*1*		2
CM	14	Floods	1				1		*1*		3
TD	15	Defences of the "Multimedia Pedagogical Conferences" projects and mini-fresks				1			1	2
TD	16					1			1	2
		TOTAL	2	2	3	1	4	1	9	8	**30**

Person(s) in charge
THUAL OLIVIER

Bibliography
Climate-energy issues, murals and mini-fresks

[1] Former les ingénieurs du XXIème siècle, The Shift Project,

https://theshiftproject.org/former-les-ingenieurs-a-la-transition

[2] La Fresque du Climat, https://fresqueduclimat.org/

[3] Wiki de La Fresque du Climat, https://fresqueduclimat.org/wiki

[4] O. Thual, La construction de mini-fresques au service d'une pédagogie active, *J. Pratiques Pédago. INP* **0912** (2020) pp. 11. [format pdf] et [diaporama]

[5] E. Di Maria, O. Thual, l'équipe enseignante de l'APP Climat et la promo 2MFEE EE 2020, Mini-Fresques, l'APP Climat 2020, *Éd. Ress. Pédago. Ouv. INP* **0525** (2020) 20h

[6] V. Dryander, O. Thual, l'équipe enseignante de l'APP Climat et la promotion MFEE EE 2021, Mini-fresques et Conférences Actives Multimédias de l'APP Climat 2021, *Éd. Ress. Pédago. Ouv. INP* **0813** (2020) 12h

IPCC reports

[7] IPCC site first page

[8] AR6 Climate Change 2021: The Physical Science Basis

· Semestre 8 MF2E FISE Parcours Energie FEP

· 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 UE PROJET MF2E S8

Choice: 2 Among 2 :

· Teaching Unit PROJETS INIT. PERSONNEL

Objectives

The objective of this teaching unit is to implement a particular methodology (numerical or experimental) to carry out a scientific project.

The skills developed are:

* Physical analysis of the problem to be treated
* Choosing an appropriate methodology
* Implementation of this methodology (existing tools or tools to develop)
* Results analysis

Person(s) in charge
DURU PAUL

· Subject Experimental Project

Objectives

Give the students the opportunity to deepen their knowledge by carrying out a project in a small group under the guidance of an educational tutor. Allow students to acquire autonomy and sense of initiative. Introduce students to project management and teamwork.

Description

The work program depends on the subject chosen in consultation between the group of students and the tutor. It focuses on the illustration, mostly experimental, and the better understanding of physical phenomena addressed in the teachings of the department.

Person(s) in charge
DURU PAUL

· Teaching Unit PROJET NUMERIQUE

Pre-requisites

None

Objectives

- study a physical problem using or developing numerical tools

- manage a group project in semi-autonomy

Person(s) in charge
BONOMETTI THOMAS

· Subject Numerical Project

Objectives

The objective of this course (in the form of a project) is to study in small groups an environmental phenomenon of your choice based on numerical simulation tools. To do this, you will have the choice of the subject and the methodology, with two possible strong orientations: starting from an existing code / numerical simulation software to study a particular phenomenon or directly developing a numerical simulation code (solving the equations of St Venant for example).

From your choice, you will realize your group project in autonomy, with the support of the supervisors to guide you in your approach.

The objectives of this course are multiple, it will be useful both from a numerical point of view to develop your skills of coding, use and understanding of the codes used in environment, to deepen and better understand a subject in environment, and also to develop your autonomy and project management skills.

The rendering will be in the form of a website, followed by an oral presentation to share your project with the rest of the class.

Description
* Project management: autonomy, group organization, time management ...
* Coding / use of software
* Deepening of a theme of personal interest
* Writing a report, ability to analyze, critique and summarize

Person(s) in charge
BONOMETTI THOMAS

· Teaching Unit PROJET RECHERCHE

Person(s) in charge
COLIN CATHERINE

· Subject Projet Recherche

Person(s) in charge
COLIN CATHERINE

· Teaching Unit AERODYNAMIQUE

· Subject Compressible Flows

Objectives

To be able to calculate flows of compressible fluids 1D and 2D

Description

I. Introduction and equation

II. Monodimensional flows

III. Shocks

IV. Theory of small disturbances

V. Characteristic method

· Subject Gas turbomachines

Objectives

This course is designed to familiarize the student with the operation of gas turbine engines (turbines, compressors, fans) and their dimensioning (drawing of blades, similarity ...)

Description

- Conservation of energy and momentum

- Operation of turbomachines (axial machines, radial machines)

- The centrifugal compressor

- The axial turbine

- Similarity and returns

- Efforts on the blades

Person(s) in charge
BAZILE RUDY

· Subject Vibration under flow

Objectives
* Know how to identify the mechanism causing a vibration problem of a structure placed in a flow.

* Knowing how to choose the acquisition and processing parameters to identify the modes of an aeroelastic system by spectral analysis.

Description

I. Physics of the interaction

* Examples and industrial context, classification by dimensional analysis, aerodynamic complements.

* Vortex-induced vibration, lock-in

* Stability analysis, damping and added stiffness (galloping, divergence)

* Aeroelastic transients, dynamic stall, hereditary damping

* State formalism, modal analysis, antisymmetric stiffness coupling (flutter flexion-torsion of a wing).

II. Experimental identification

* Periodic estimation of Welch, statistical properties

* Method of identification of fluidelastic coupling (direct or indirect)

* Filtering relations (Wiener-Lee), consistency function

* Practical application (TP) to spectral and correlation analysis "real time" of a flexible structure in a turbulent flow. Identification of a Movement Induced Vibration (MIV) coupling

Person(s) in charge
HARRAN GILLES

Bibliography
* Polycopié Vibrations Sous Ecoulements Turbulents, Physique et modélisation du couplage aéroélastique, G. Harran
* Polycopié Vibrations Sous Ecoulements Turbulents, Démarche expérimentale et problème d'identification, G. Harran

* F. Axisa, Modélisation des systèmes mécaniques -Vibrations sous Ecoulements (Hermès)
* E. de Langre, Fluides et solides, Ecole Polytechnique, 2002
* A. Preumont, Random Vibration and Spectral Analysis, Kluwer, 1994
* P. Hémon, Vibrations des structures couplées au vent, Ecole Polytechnique, 2006
* E.H. Dowell, A modern course in aeroelasticity, Kluwer, 2004
* R.-J. Gibert, Vibrations des structures - Interactions avec les fluides, Sources d'excitation aléatoires, 1988

· Teaching Unit SYSTEMES INDUSTRIELS

· Subject Physical Analysis of Industrial Processes

Objectives

The objective of this course is to take an interest in the physical phenomena involved in processes of energy or matter transformation. It details the industrial applications concerned, the physical phenomena that occur there and the possible coupling with chemical reactions.

Description

Industrial Issues and Scientific Competence

Gas-liquid transfer in monoliths Description and sizing of columns (distillation - extraction)

Stagnant film theory and reactive transfer

Design office: micro-macro analysis

Person(s) in charge
CLIMENT ERIC

Bibliography

Transport Phenomena - Brid, Stewart and Lightfoot.

· Subject Thermodynamics of Machines

Objectives

The purpose of this course is to apply the 1st year thermodynamics course to non-condensable gas cycle machines.

Description

The first lesson is dedicated to thermodynamic reminders of open machines. The thermodynamics of machines is applied to the study of gas turbines and turbojets (3 sessions). The optimization of the machine cycles is treated with the ThermOptim software (6 sessions). This software will also be used in the 3rd year in the "Thermal Machines" module (3A / MOST)

Person(s) in charge
BASILLE JEAN-LUC

· Subject Simulation Hydrodynamique et Transferts

Person(s) in charge
LALANNE BENJAMIN

· Teaching Unit PROCESSUS MULTI-ECHELLES

· Subject Vibration under flow

Objectives

* Know how to identify the mechanism causing a vibration problem of a structure placed in a flow.

* Knowing how to choose the acquisition and processing parameters to identify the modes of an aeroelastic system by spectral analysis.

Description

I. Physics of the interaction

* Examples and industrial context, classification by dimensional analysis, aerodynamic complements.

* Vortex-induced vibration, lock-in

* Stability analysis, damping and added stiffness (galloping, divergence)

* Aeroelastic transients, dynamic stall, hereditary damping

* State formalism, modal analysis, antisymmetric stiffness coupling (flutter flexion-torsion of a wing).

II. Experimental identification

* Periodic estimation of Welch, statistical properties

* Method of identification of fluidelastic coupling (direct or indirect)

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Person(s) in charge
HARRAN GILLES

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* Polycopié Vibrations Sous Ecoulements Turbulents, Démarche expérimentale et problème d'identification, G. Harran

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* A. Preumont, Random Vibration and Spectral Analysis, Kluwer, 1994
* P. Hémon, Vibrations des structures couplées au vent, Ecole Polytechnique, 2006
* E.H. Dowell, A modern course in aeroelasticity, Kluwer, 2004
* R.-J. Gibert, Vibrations des structures - Interactions avec les fluides, Sources d'excitation aléatoires, 1988

· Subject Microfluidic Introduction

Pre-requisites

Meca Fluides 1 et 2

Objectives

Present important and useful concepts to microfluidics focusing on small scale hydrodynamics and the effect of surface forces on Stokes flows.

Targeted skills

Ability to design, size and model systems for energy, transportation and processes.

Ability to design, develop and characterize control systems for the regulation and control of hydraulic and energy devices and for the development of nomadic and embedded systems.

Ability to model multi-scale and / or multi-physics and / or stochastic mechanical problems.

Description

1. Introduction: MEMS to microfluidics

2. Physics at the micrometric scale

3. Hydrodynamics of microfluidic systems

4. Interfacial hydrodynamics

5. BE: Microfabrication - Applications

Number of hours
12,5

Person(s) in charge
TORDJEMAN PHILIPPE

Teaching method
En présence

Teaching language
french or english

Bibliography

Microfluidics Tabelling (Belin)

· Subject TEDT : Dispertion Turbulente

Person(s) in charge
ROIG VERONIQUE

Organizational unit

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

Ingénieur ENSEEIHT Mécanique et Génie Hydraulique 3ème année

MORE INFO

ECTS credits : 60

Organization

· **Année 3A-Méc-GH-FISE**

· **Choix de Parc. Semestre 9 - 3A MF2E**

Choice: 1 Among 2 :

· **Parcours Eco-Energie - Semestre 9**

· **Teaching Unit Advanced critical computer systems**

· **Subject Optimization design Project**

· **Subject Life cycle analysis Project**

· **Subject Process Designs Project**

· **Subject Process Design and Analysis**

· **Subject Systemic modeling in Bond Graph**

· **Subject Ecodesign, Life cycle analysis, project management**

· **Subject Optimization Design**

· **Teaching Unit Hybrid Systems, Smart Grids and Electrochemical Storage**

· **Subject Hybrid energy systems Project**

Objectives

- Develop a multiphysics system model using Bond Graph formalism;

- Analyze energy transfer and energy coupling in a multiphysics system;

- Analyze system power profile and evaluate the interest of its hybridization;

- Sizing the hybrid system sources (fuel cell and supercapacitor);

- Simulate a frequency energy management strategy.

Description

This project consists in applying the Bond Graph formalism for the modeling of an EHA (ElectroHydrostatic Actuator) of an Airbus 320.

The project also aims to feed the EHA through a hybrid energy system.Indeed, the student must analyze the system power profile (here the EHA during a flight sequence) and conclude on the interest of its hybridization.The hybridization here consists in associating a PEM (Proton Exchange Membrane) fuel cell with a supercapacitor.The student has to size the sources and apply a frequency energy management strategy to respect the dynamic characteristics of

the hybrid system sources.

Number of hours
10.5

Teaching method
En présence

· Subject Fuel cells project

Objectives

- Evaluate two complementary methodologies for experimental characterization of an electrochemical component:

Dynamic plot of voltage-current curve.

Electrochemical impedance spectroscopy.

- Parameterize a dynamic model of PEM (Proton Exchange Membrane) fuel cell based on the performed experimental characterizations.

- Evaluate the dynamic behavior of the PEM fuel cell providing current ripples generated by the connection of DC/DC static converters (Buck, Boost).

Description

- Electrical and fluidic assembly of an energy conversion manipulation based on an electrolyzer and a fuel cell.

- Study of two electrochemical components characterization methodology: the dynamic tracing of the voltage-current curve and the electrochemical impedance spectroscopy.

- Parametric identification: obtain the model parameters of an electrochemical component from the experimental characterizations.

Number of hours
10.5

Teaching method
En présence

Teaching language
French

· Subject Decentralized and embedded electrical networks

Objectives
* Know the characteristic criteria (security, stability ...) of an embedded or decentralized electrical network compared to a conventional distribution network.

* Understand the main elements (storage ...) used in the design of such a network.
* Propose different network architectures in relation to a given specification.
* Be able to read a complete electrical diagram of a photovoltaic installation by being able to identify the various devices necessary as well as their function and sizing.

Description

1. Security and reliability

* Related concepts (fault isolation, reconfiguration, backup network, ...)
* Example of an aeronautical network

2. Mission Profile to be completed

* Interest of sources hybridization to optimize their use
* Using the Ragone plan in sizing storage units

3. Quality (AC and DC networks)

* Definition of quality standards (current, voltage)
* Quality Improvement Solutions

4. Stability (AC and DC networks)

* Architecture and operation of AC power grids
* Principles of frequency and voltage settings on networks (primary, secondary adjusments)
* Power limitation of transportation lines
* Instability related to filter - regulated system interactions

5. EMC issues

* Coupling types
* Disturbance measurements and means of protection
* EMC issues for power grids
* Problems associated with indirect lightning strike

6. Study of PV installations connected to the distribution network

* Definitions of electrical switchgears and classes of protection
* LV earth connection diagram
* Electrical surge protection
* Study of plant schematic examples

Person(s) in charge
ROUX Nicolas
Nicolas.Roux@enseeiht.fr
Phone 2428

Teaching method
En présence

Teaching language
French

Bibliography

T. Christen et M. W. Carlen, « Theory of Ragone plots », Journal of Power Sources 91, pp. 210-216.

O. Gergaud, « Modélisation énergétique et optimisation économique d'un système de production éolien et photovoltaïque couplé au réseau et associé à un accumulateur », Thèse ENS Cachan, 2002.

· Subject Energy Hybridization of Systems

Objectives

At the end of the course, the student will be able to identify the architectures of the hybrid systems and to know the energy/ power characteristics of some sources and energy storage elements.

He will be able to analyze the mission of an energy system, to evaluate the relevance of its hybridization and to design a hybrid system.

The student will also be able to propose an energy management strategy of a multi-source energy system by respecting the intrinsic characteristics of the associated sources.

Description

In addition to the hybridization theorie and the energy management of multi-source systems, the course is based on several examples of hybrid energy systems from the Laplace laboratory experience feedback.These examples relate in particular to the transport field (aeronautics, rail and road).

Number of hours
8.75

Teaching method
En présence

Teaching language
French

· Subject Electrochemical components

· Subject Electrochemistry

· Subject Habitat project

· Subject Habitat

· Subject Smart Grids

· Teaching Unit Renewable energies

· Subject BER Valo Bio HT

· Subject Agrofuels Project

· Subject Systèmes Eoliens

· Subject Biofuel systems

· **Subject High temperature biomass valorization**

· **Subject Photovoltaic Project**

· **Teaching Unit General education**

· **Subject 2nd Year Internship Defense**

· **Subject English language**

· **Subject Energy and Sustainable Dev Conferences**

· **Sem 9 MF2E Parcours Modélisation Simulation Numérique (MSN)**

Choice: 1 Among 1 :

· **Spécialité MSN-3A-MF2E**

· **Teaching Unit SOFT AND HUMAN SKILLS**

Person(s) in charge
HULL ALEXANDRA

· **Subject Professional English-LV1-Semestre 9**

· **Subject Anglais Scientifique**

· **Choix 2 Anglais Professionnel - 3A**

Choice: 1 Among 1 :

· **Subject Anglais Clinique**

· **Subject Anglais de Cambridge ou Projet**

· **Subject Careers, Leadership & Management-S9**

Choice: 2 Among 3 :

· **Subject Conduite d'opération en hydraulique (MF2E)**

Objectives

Give future engineers the notions and tools to be operational in project management, here applied to hydraulic engineering.

Description

- Project manager & company manager".

Role of each stakeholder. Regulatory files: authorization file, nomenclature of the law on water, relationship with the services of the Administration (DREAL, DDT, AFB ...). Schedule of operation.

- "The standardized missions of the project manager".

APS, AVP, PRO, DCE, VISA, DET, OPR.

- "Business Consultation "

Constitution of technical documents for consultation (CCTP, BP, DQE). Presentation of the repositories

(Eurocodes, fascicles, standards, GTR).

Person(s) in charge
LAUVERGNIER FRANCOIS

· Subject Controverses dans un monde en transition (MF2E)

· Subject RSE (MF2E)

· Subject IT and Computer Law (SN)

· Subject Strategic and Critical Thinking (SN)

· Subject Bureau d'Etudes Industrielles (BEI/BEE)/Conférence

· Teaching Unit MODELISATION

· Subject Modèles pour les Interfaces

Person(s) in charge
LEGENDRE DOMINIQUE

· Subject Modélisation en turbulence

Person(s) in charge
ESTIVALEZES JEAN-LUC

· Subject Modélisation des trasferts proche paroi

Person(s) in charge
CHEDEVERGNE FRANCOIS

· Teaching Unit APPLICATIONS A L'AERODYNAMIQUE

Person(s) in charge
ALBAGNAC JULIE

· Subject Aérodynamique

Person(s) in charge
ALBAGNAC JULIE

· Subject Aéroacoustique

Person(s) in charge
PIOT ESTELLE

· Subject Interactions Fluide-Structure

Person(s) in charge
MOUGEL JEROME

· Teaching Unit ENVIRONNEMENT POUR LE CALCUL INTENSIF

· Subject BES langages avancés (C++, Phyton)

Person(s) in charge
STOUKOV ALEXEI

· Subject Environnement Logiciel du Calcul Scientifique

Person(s) in charge
AMESTOY PATRICK

· Subject Techniques de génération maillage, pré/post processing

Person(s) in charge
NEAU HERVE

· Teaching Unit PROJETS DE MODELISATION ET SIMULATION NUMERIQUE

· Subject BES Schémas Compressibles

Person(s) in charge
MISDARIIS ANTONY

· Subject BES Schémas Incompressibles

Person(s) in charge
ESTIVALEZES JEAN-LUC

· Subject BES Nouveaux codes et codes industriels

Person(s) in charge
RIBER ELEONORE

· Teaching Unit METHODES NUMERIQUES POUR LE CALCUL SCIENTIFIQUE EN AERODYNAM

· Subject Méthodes numérique p/ simulation ds écoulemT incompressibles

Person(s) in charge
ESTIVALEZES JEAN-LUC

· Subject Méthodes Numérique p/Simulation ds Ecoulements Compressibles

Person(s) in charge
ESTIVALEZES JEAN-LUC

· Subject Assimilation des données

Person(s) in charge
THUAL OLIVIER

· Spécialité MSN-Env.-3A MF2E

· Teaching Unit SOFT AND HUMAN SKILLS

Person(s) in charge
HULL ALEXANDRA

· Subject Professional English-LV1-Semestre 9

· Subject Anglais Scientifique

· Choix 2 Anglais Professionnel - 3A

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· Subject Anglais de Cambridge ou Projet

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Choice: 2 Among 3 :

· Subject Conduite d'opération en hydraulique (MF2E)

Objectives

Give future engineers the notions and tools to be operational in project management, here applied to hydraulic engineering.

Description

- Project manager & company manager".

Role of each stakeholder. Regulatory files: authorization file, nomenclature of the law on water, relationship with the services of the Administration (DREAL, DDT, AFB ...). Schedule of operation.

- "The standardized missions of the project manager".

APS, AVP, PRO, DCE, VISA, DET, OPR.

- "Business Consultation "

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(Eurocodes, fascicles, standards, GTR).

Person(s) in charge
LAUVERGNIER FRANCOIS

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· Subject RSE (MF2E)

· Subject IT and Computer Law (SN)

· Subject Strategic and Critical Thinking (SN)

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· Subject Modèles pour les Interfaces

Person(s) in charge
LEGENDRE DOMINIQUE

· Subject Modélisation en turbulence

Person(s) in charge
ESTIVALEZES JEAN-LUC

· Subject Modélisation des trasferts proche paroi

Person(s) in charge
CHEDEVERGNE FRANCOIS

· Teaching Unit ENVIRONNEMENT POUR LE CALCUL INTENSIF

· Subject BES langages avancés (C++, Phyton)

Person(s) in charge
STOUKOV ALEXEI

· Subject Environnement Logiciel du Calcul Scientifique

Person(s) in charge
AMESTOY PATRICK

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Person(s) in charge
NEAU HERVE

· Teaching Unit PROJETS DE MODELISATION ET SIMULATION NUMERIQUE

· Subject BES Schémas Compressibles

Person(s) in charge
MISDARIIS ANTONY

· Subject BES Schémas Incompressibles

Person(s) in charge
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· Subject BES Nouveaux codes et codes industriels

Person(s) in charge
RIBER ELEONORE

· Teaching Unit METHODES NUMERIQUES POUR LE CALCUL SCIENTIFIQUE EN AERODYNAM

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ESTIVALEZES JEAN-LUC

· Subject Méthodes Numérique p/Simulation ds Ecoulements Compressibles

Person(s) in charge
ESTIVALEZES JEAN-LUC

· Subject Assimilation des données

Person(s) in charge
THUAL OLIVIER

· Teaching Unit ECOULEMENTS ENVIRONNEMENTAUX

Pre-requisites
* Basis on Dynamics Flows
* Basis on free surface water flows

· Subject Couche Limite Atmosphérique (CLAT)

Pre-requisites
* Thermodynamic Basis
* Mechanic Flows Basis

Person(s) in charge
THUAL OLIVIER

· Subject Hydrodynamique Littorale et Cotière (HCLO)

Person(s) in charge
ASTRUC DOMINIQUE

· Subject Transport et Mélange (TREM)

Person(s) in charge
PRAUD OLIVIER

· Spécialité MSN-Ener. - 3A MF2E

· Teaching Unit SOFT AND HUMAN SKILLS

Person(s) in charge
HULL ALEXANDRA

· Subject Professional English-LV1-Semestre 9

· Subject Anglais Scientifique

· Choix 2 Anglais Professionnel - 3A

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Choice: 2 Among 3 :

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Objectives

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Person(s) in charge
LAUVERGNIER FRANCOIS

· Subject Controverses dans un monde en transition (MF2E)

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· Subject Modèles pour les Interfaces

Person(s) in charge
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· Subject Modélisation en turbulence

Person(s) in charge
ESTIVALEZES JEAN-LUC

· Subject Modélisation des trasferts proche paroi

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Person(s) in charge
STOUKOV ALEXEI

· Subject Environnement Logiciel du Calcul Scientifique

Person(s) in charge
AMESTOY PATRICK

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Person(s) in charge
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· Teaching Unit PROJETS DE MODELISATION ET SIMULATION NUMERIQUE

· Subject BES Schémas Compressibles

Person(s) in charge
MISDARIIS ANTONY

· Subject BES Schémas Incompressibles

Person(s) in charge
ESTIVALEZES JEAN-LUC

· Subject BES Nouveaux codes et codes industriels

Person(s) in charge
RIBER ELEONORE

· Teaching Unit METHODES NUMERIQUES POUR LE CALCUL SCIENTIFIQUE EN AERODYNAM

· Subject Méthodes numérique p/ simulation ds écoulemT incompressibles

Person(s) in charge
ESTIVALEZES JEAN-LUC

· Subject Méthodes Numérique p/Simulation ds Ecoulements Compressibles

Person(s) in charge
ESTIVALEZES JEAN-LUC

· Subject Assimilation des données

Person(s) in charge
THUAL OLIVIER

· Teaching Unit TURBULENCE ET ECOULEMENTS MULTIPHASES

· Subject Physique des écoulements turbulents incompressibles (PHET)

Person(s) in charge
PRAUD OLIVIER

· Subject Ecoulements Disphasiques (DIPH)

Person(s) in charge
LEGENDRE DOMINIQUE

· Subject Transferts en Milieux disphasiques et turbulents (TMRC)

Person(s) in charge
MAGNAUDET JACQUES

· Spécialité MSN-BD - 3A MF2E

· Teaching Unit SOFT AND HUMAN SKILLS

Person(s) in charge
HULL ALEXANDRA

· Subject Professional English-LV1-Semestre 9

· Subject Anglais Scientifique

· Choix 2 Anglais Professionnel - 3A

Choice: 1 Among 1 :

· Subject Anglais Clinique

· Subject Anglais de Cambridge ou Projet

· Subject Careers, Leadership & Management-S9

Choice: 2 Among 3 :

· Subject Conduite d'opération en hydraulique (MF2E)

Objectives

Give future engineers the notions and tools to be operational in project management, here applied to hydraulic engineering.

Description

- Project manager & company manager".

Role of each stakeholder. Regulatory files: authorization file, nomenclature of the law on water, relationship with the services of the Administration (DREAL, DDT, AFB ...). Schedule of operation.

- "The standardized missions of the project manager".

APS, AVP, PRO, DCE, VISA, DET, OPR.

- "Business Consultation "

Constitution of technical documents for consultation (CCTP, BP, DQE). Presentation of the repositories

(Eurocodes, fascicles, standards, GTR).

Person(s) in charge
LAUVERGNIER FRANCOIS

· Subject Controverses dans un monde en transition (MF2E)

· Subject RSE (MF2E)

· Subject IT and Computer Law (SN)

· Subject Strategic and Critical Thinking (SN)

· Subject Bureau d'Etudes Industrielles (BEI/BEE)/Conférence

· Teaching Unit MODELISATION

· Subject Modèles pour les Interfaces

Person(s) in charge
LEGENDRE DOMINIQUE

· Subject Modélisation en turbulence

Person(s) in charge

ESTIVALEZES JEAN-LUC

· Subject Modélisation des trasferts proche paroi

Person(s) in charge
CHEDEVERGNE FRANCOIS

· Teaching Unit APPLICATIONS A L'AERODYNAMIQUE

Person(s) in charge
ALBAGNAC JULIE

· Subject Aérodynamique

Person(s) in charge
ALBAGNAC JULIE

· Subject Aéroacoustique

Person(s) in charge
PIOT ESTELLE

· Subject Interactions Fluide-Structure

Person(s) in charge
MOUGEL JEROME

· Teaching Unit ENVIRONNEMENT POUR LE CALCUL INTENSIF

· Subject BES langages avancés (C++, Phyton)

Person(s) in charge
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· Subject Environnement Logiciel du Calcul Scientifique

Person(s) in charge
AMESTOY PATRICK

· Subject Techniques de génération maillage, pré/post processing

Person(s) in charge
NEAU HERVE

· Teaching Unit METHODES NUMERIQUES POUR LE CALCUL SCIENTIFIQUE EN AERODYNAM

· Subject Méthodes numérique p/ simulation ds écoulemT incompressibles

Person(s) in charge
ESTIVALEZES JEAN-LUC

· Subject Méthodes Numérique p/Simulation ds Ecoulements Compressibles

Person(s) in charge
ESTIVALEZES JEAN-LUC

· Subject Assimilation des données

Person(s) in charge
THUAL OLIVIER

· Teaching Unit INTELLIGENCE ARTIFICIELLE EN GEOSCIENCES

· Subject Méthodes mathématiques pour l'exploitation des données

Objectives

Illustrate different mathematical methods for analyzing and using data in geoscience

Targeted skills
* Recognize the different possible sources of uncertainty in environmental modeling
* Identify and use methodologies for estimation and propagation of uncertainty
* Describe the practical applications of data assimilation in the environment
* Recognize an overall method for data assimilation and experimentation

Description

Part 1: Uncertainty Quantification

Part 2: Ensemble Methods for Data Assimilation

Person(s) in charge
ROUX Helene
Helene.Roux@imft.fr
Phone 2840

THUAL Olivier
Olivier.Thual@imft.fr
Phone 2945

ROUX HELENE

Teaching method
Hybride

Teaching language
French

· Subject Utilisation de l'intelligence artificielle en prévision

Objectives

Illustrate different possible uses of artificial intelligence methods for forecasting in geosciences

Targeted skills
* Identify and use classic learning methods
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Description

Part 1: Machine learning for forecasting

Part 2: Neural networks for classification in geoscience

Person(s) in charge
CARLIER AXEL

Teaching method
Hybride

Teaching language
French

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· Teaching Unit ECOULEMENTS ENVIRONNEMENTAUX

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Pre-requisites
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* Mechanic Flows Basis

Person(s) in charge
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· Subject Hydrodynamique Littorale et Cotière (HCLO)

Person(s) in charge
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Person(s) in charge

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Person(s) in charge
ESTIVALEZES JEAN-LUC

· Subject Assimilation des données

Person(s) in charge
THUAL OLIVIER

· Teaching Unit TURBULENCE ET ECOULEMENTS MULTIPHASES

· Subject Physique des écoulements turbulents incompressibles (PHET)

Person(s) in charge
PRAUD OLIVIER

· Subject Ecoulements Disphasiques (DIPH)

Person(s) in charge
LEGENDRE DOMINIQUE

· Subject Transferts en Milieux disphasiques et turbulents (TMRC)

Person(s) in charge
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Person(s) in charge
CARLIER AXEL

Teaching method
Hybride

Teaching language
French

· Sem.9 MF2E Parcours Sci. de l'Eau et l'Environnement (SEE)

Choice: 1 Among 1 :

· Spécialité SEE-3A MF2E

· Teaching Unit SOFT AND HUMAN SKILLS

Person(s) in charge
HULL ALEXANDRA

· Subject Professional English-LV1-Semestre 9

· Subject Anglais Scientifique

· Choix 2 Anglais Professionnel - 3A

Choice: 1 Among 1 :

· Subject Anglais Clinique

· Subject Anglais de Cambridge ou Projet

· Subject Careers, Leadership & Management-S9

Choice: 2 Among 3 :

· Subject Conduite d'opération en hydraulique (MF2E)

Objectives

Give future engineers the notions and tools to be operational in project management, here applied to hydraulic engineering.

Description

- Project manager & company manager".

Role of each stakeholder. Regulatory files: authorization file, nomenclature of the law on water, relationship with the services of the Administration (DREAL, DDT, AFB ...). Schedule of operation.

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Person(s) in charge
LAUVERGNIER FRANCOIS

· Subject Controverses dans un monde en transition (MF2E)

· Subject RSE (MF2E)

· Subject IT and Computer Law (SN)

· Subject Strategic and Critical Thinking (SN)

· Subject Bureau d'Etudes Industrielles (BEI/BEE)/Conférence

· Teaching Unit ECOULEMENTS ENVIRONNEMENTAUX

Pre-requisites
* Basis on Dynamics Flows
* Basis on free surface water flows

· Subject Couche Limite Atmosphérique (CLAT)

Pre-requisites
* Thermodynamic Basis
* Mechanic Flows Basis

Person(s) in charge
THUAL OLIVIER

· Subject Hydrodynamique Littorale et Cotière (HCLO)

Person(s) in charge
ASTRUC DOMINIQUE

· Subject Transport et Mélange (TREM)

Person(s) in charge
PRAUD OLIVIER

· Teaching Unit HYDROLOGIE

· Subject Hydrologie approfondie, bassin versant et milieu urbain

Objectives

Hydrology deals with that part of the hydrological cycle occurring around the earth surface. The hydrological cycle from precipitation to river discharge is considered, as well as the way human activity can influence water flows.

Targeted skills

- Distinguish the control processes of a given system:

  Watersheds

  Distribution system

  Urban drainage system

- Formalize this understanding into a system of mathematical relationships that provides a reliable prediction of the system

- Use this model for operational forecasts useful for structural design, management and decision making

Description

- Presentation of the "big" water cycle (Watershed hydrology)

  Interception

  Snowmelt

  Evapotranspiration

  Infiltration

  Hydrological response

  Surface runoff and water paths

- Presentation of the "small" water cycle (urban systems)

- Data collection and analysis issues

- Implementation of a hydrological model

- Theory and exercise based learning

Number of hours
35

Person(s) in charge
CASSAN Ludovic
Ludovic.Cassan@imft.fr
Phone 2971

ROUX Helene
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ROUX HELENE

Teaching method
En présence

Teaching language
French

· Subject Hydrologie Statistique (HSTA)

Objectives

Enhance hydrology skills using statistical and probabilistic approaches by example analysis and statistical modeling of rainfall-runoff processes, with methods of processing spatiotemporal data adapted to the problems of hydrology.

Description
* Univariate Statistical Analysis and Probability Law Adjustments
* Extreme variables (annual floods), project floods / rare events (Poisson's law).
* Multivariate statistical analysis, Bayesian estimation, multiple regression, correlation multiple, and Principal Component Analysis (PCA): applications to criticism,
* Reconstitution, and/or mapping of hydrological data.
* Statistical analysis of time series from measurement networks hydrometeorological and hydrogeological.
* Time correlation functions (delays). Statistical identification of the rainfall-flow relationship (P(t)==>(Qt)).
* Geostatistical estimation using the theory of regionalized variables and/or modeling of temporal hydrological variables treated as random processes (your choice) :case study that may vary from year to year).

Number of hours
17,5

Person(s) in charge
ABABOU RACHID

· Subject L'Eau en milieu urbain (EURB)

Person(s) in charge
DARTUS DENIS

· Subject Hydrologie des Transferts (HTRA)

Person(s) in charge
DEBENEST GERALD

· Teaching Unit AMENAGEMENT ET OUVRAGES

· Subject Mécanique des sols (MSOL)

Objectives

Obtain the basic notions of soil mechanics in order to be able to interact with geotechnicians.

Description

-What is a floor?

- soil classification

-water in the soil

- soil resistance

- in-lab and in-situ recognition

Number of hours
17,5

Person(s) in charge
CAMBEFORT CORINNE

· Subject Ingénierie des ouvrages hydrauliques (INGO)

Objectives

To show how to use the knowledge acquired in the 3 years for the design and realization of facilities hydraulic and hydroelectric.

Description

The hydrology of a development, water intake, intake and discharge works, turbines and available power, environmental impacts and their reduction measures. Regulations to apply.

Number of hours
17,5

Person(s) in charge
DUMOND LIONEL

· Subject Impacts des Aménagements Industriels (IMPA)

Objectives

The aim of this environment module is to make engineering students aware of the need to take environmental protection into account during their future professional activities.

Description

1/ Hydraulic developments - environmental impact studies - soft development of the watercourse - water living environment

2/ Environment and business - environment-business plans - conventional waste and industrial

3/ Air and soil pollution

Number of hours

8,75

Person(s) in charge
BREBION JEROME

· Subject Risques et Prévention (RISP)

Objectives

To make students aware of the notions of risk in industrial and environmental contexts.

Presentation of analysis methods.

Description

To make students aware of the notions of risk in industrial and environmental contexts.

Presentation of analysis methods.

Number of hours
8,75

Person(s) in charge
CODRON PATRICK

· Teaching Unit MODELISATION HYDRAULIQUE AVANCEE

· Subject Systèmes d'Information Géographique (SIG)

Objectives

These courses and tutorials are designed to introduce students to the principles of the Systems Information Geographic and their use.

Description

- Course: "Introduction to GIS

This course explains the fundamental principles of Geographic Information Systems. Course Outline:

Definition of a GIS, the components of a GIS (data, methods, human resources, etc.), the use of GIS and the use of GIS in the development of a GIS. and hardware), main functionalities, data representation mode (raster, vector),data structuring (storage models), repositories and cartographic projections (geoid, ellipsoid and geodetic systems), georeferencing. The different notions are illustrated in the tutorial framework.

Course: "Relief representation and digital terrain model".

This course provides an overview of the cartographic methods used to represent relief and exposes the theoretical basis for creating and manipulating digital terrain models (MNT). The concepts seen during the course are applied in the framework of tutorials.Course outline: Representation of the relief on a map (definition, side points, contour lines, etc.), special figures, illumination and fading, hypsometric tints). General characteristics of DTM (definition, mode of representation, principles of elaboration). Data sources for the construction of MNT. Interpolation methods: global interpolation method (area of trend), local interpolation methods (moving average,inverse distance weighting, overview of kriging). Information derived from DTMs: slope and orientation, flow direction (method D4 and D8), calculation of drained surfaces, extraction of watersheds and network hydrographic, topological description of the hydrographic network.

Contents of the TSTs :

Introduction to ArcGIS software (and Spatial Analyst and 3D analyst extensions) and Idrisi software.

1) Introduction to ArcGIS software functionalities

2) Georeferencing of a topographic map (Idrisi)

3) Creation and manipulation of DTM - spatial analysis in raster mode (ArcGIS)

4) Network management

5) Modelling and assessment of soil sensitivity to erosion at the regional scale in France (ArcGIS)

Number of hours
14 de TD

Person(s) in charge
MONTEIL CLAUDE

· Subject Modélisation Avancée des Ecoulements à Surface Libre (MAESL)

Objectives

Use advanced 1D and 2D free surface flow modeling software, taking into account the following accounts for sediment and pollutant transport

Description

- use of the software for solving the Saint-Venant equations 1D/2D HECRAS, TELEMAC

- use of sediment transport modules HECHMS, SISYPHE

- use of associated pre- and post-processing software (ArcGIS, BlueKenue, Fudaa, Paraview)

Person(s) in charge
CASSAN LUDOVIC

· Subject Transport Sédimentaire et Morphodynamique (TSMO)

Objectives

Introduction to the physical processes of sediment transport by flows and methods estimating sedimentary fluxes and the resulting changes in the bottom.

Description

I. Geomorphology of coastlines and rivers

II. Local processes and morphodynamic models

III. Sediment properties

IV. Setting in motion

V. Modeling of Carriage Transport

VI. Transport modeling by suspension

VII. Multi-phase modelling approaches

Number of hours
17,5

Person(s) in charge
ASTRUC DOMINIQUE

Bibliography

- Principles of Sediment Transport in Rivers, Estuaries and Coastal Seas, LC. Van Rijn 1990 Aqua Publications.

- Hydraulics of sediment transport, W.H. Graf 1984 Water Ressources Publications

· Subject Codes de calcul en environnement (MODE)

Person(s) in charge
BONOMETTI THOMAS

· Teaching Unit TRANSITION ENERGETIQUE ET ENERGIES RENOUVELABLES

· Subject Transition énergétique et énergies renouvelables

Person(s) in charge
DURU PAUL

· Spécialité SEE-Aéro - 3A MF2E

· Teaching Unit SOFT AND HUMAN SKILLS

Person(s) in charge
HULL ALEXANDRA

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CODRON PATRICK

· Teaching Unit MODELISATION HYDRAULIQUE AVANCEE

· Subject Systèmes d'Information Géographique (SIG)

Objectives

These courses and tutorials are designed to introduce students to the principles of the Systems Information Geographic and their use.

Description

- Course: "Introduction to GIS

This course explains the fundamental principles of Geographic Information Systems. Course Outline:

Definition of a GIS, the components of a GIS (data, methods, human resources, etc.), the use of GIS and the use of GIS in the development of a GIS. and hardware), main functionalities, data representation mode (raster, vector),data structuring (storage models), repositories and cartographic projections (geoid, ellipsoid and geodetic systems), georeferencing. The different notions are illustrated in the tutorial framework.

Course: "Relief representation and digital terrain model".

This course provides an overview of the cartographic methods used to represent relief and exposes the theoretical basis for creating and manipulating digital terrain models (MNT). The concepts seen during the course are applied in the framework of tutorials.Course outline: Representation of the relief on a map (definition, side points, contour lines, etc.), special figures, illumination and fading, hypsometric tints). General characteristics of DTM (definition, mode of representation, principles of elaboration). Data sources for the construction of MNT. Interpolation methods: global interpolation method (area of trend), local interpolation methods (moving average,inverse distance weighting, overview of kriging). Information derived from DTMs: slope and orientation, flow direction (method D4 and D8), calculation of drained surfaces, extraction of watersheds and network hydrographic, topological description of the hydrographic network.

Contents of the TSTs :

Introduction to ArcGIS software (and Spatial Analyst and 3D analyst extensions) and Idrisi software.

1) Introduction to ArcGIS software functionalities

2) Georeferencing of a topographic map (Idrisi)

3) Creation and manipulation of DTM - spatial analysis in raster mode (ArcGIS)

4) Network management

5) Modelling and assessment of soil sensitivity to erosion at the regional scale in France (ArcGIS)

Number of hours
14 de TD

Person(s) in charge
MONTEIL CLAUDE

· Subject Modélisation Avancée des Ecoulements à Surface Libre (MAESL)

Objectives

Use advanced 1D and 2D free surface flow modeling software, taking into account the following accounts for sediment and pollutant transport

Description

- use of the software for solving the Saint-Venant equations 1D/2D HECRAS, TELEMAC

- use of sediment transport modules HECHMS, SISYPHE

- use of associated pre- and post-processing software (ArcGIS, BlueKenue, Fudaa, Paraview)

Person(s) in charge
CASSAN LUDOVIC

· Subject Transport Sédimentaire et Morphodynamique (TSMO)

Objectives

Introduction to the physical processes of sediment transport by flows and methods estimating sedimentary fluxes and the resulting changes in the bottom.

Description

I. Geomorphology of coastlines and rivers

II. Local processes and morphodynamic models

III. Sediment properties

IV. Setting in motion

V. Modeling of Carriage Transport

VI. Transport modeling by suspension

VII. Multi-phase modelling approaches

Number of hours
17,5

Person(s) in charge
ASTRUC DOMINIQUE

Bibliography

- Principles of Sediment Transport in Rivers, Estuaries and Coastal Seas, LC. Van Rijn 1990 Aqua Publications.

- Hydraulics of sediment transport, W.H. Graf 1984 Water Ressources Publications

· Subject Codes de calcul en environnement (MODE)

Person(s) in charge
BONOMETTI THOMAS

· Teaching Unit TRANSITION ENERGETIQUE ET ENERGIES RENOUVELABLES

· Subject Transition énergétique et énergies renouvelables

Person(s) in charge
DURU PAUL

· Spécialité SEE-BD - 3A MF2E

· Teaching Unit SOFT AND HUMAN SKILLS

Person(s) in charge
HULL ALEXANDRA

· Subject Professional English-LV1-Semestre 9

· Subject Anglais Scientifique

· Choix 2 Anglais Professionnel - 3A

Choice: 1 Among 1 :

· Subject Anglais Clinique

· Subject Anglais de Cambridge ou Projet

· Subject Careers, Leadership & Management-S9

Choice: 2 Among 3 :

· Subject Conduite d'opération en hydraulique (MF2E)

Objectives

Give future engineers the notions and tools to be operational in project management, here applied to hydraulic engineering.

Description

- Project manager & company manager".

Role of each stakeholder. Regulatory files: authorization file, nomenclature of the law on water, relationship with the services of the Administration (DREAL, DDT, AFB ...). Schedule of operation.

- "The standardized missions of the project manager".

APS, AVP, PRO, DCE, VISA, DET, OPR.

- "Business Consultation "

Constitution of technical documents for consultation (CCTP, BP, DQE). Presentation of the repositories

(Eurocodes, fascicles, standards, GTR).

Person(s) in charge
LAUVERGNIER FRANCOIS

· Subject Controverses dans un monde en transition (MF2E)

· Subject RSE (MF2E)

· Subject IT and Computer Law (SN)

· Subject Strategic and Critical Thinking (SN)

· Subject Bureau d'Etudes Industrielles (BEI/BEE)/Conférence

· Teaching Unit ECOULEMENTS ENVIRONNEMENTAUX

Pre-requisites
* Basis on Dynamics Flows
* Basis on free surface water flows

· Subject Couche Limite Atmosphérique (CLAT)

Pre-requisites
* Thermodynamic Basis
* Mechanic Flows Basis

Person(s) in charge
THUAL OLIVIER

· Subject Hydrodynamique Littorale et Cotière (HCLO)

Person(s) in charge
ASTRUC DOMINIQUE

· Subject Transport et Mélange (TREM)

Person(s) in charge
PRAUD OLIVIER

· Teaching Unit INTELLIGENCE ARTIFICIELLE EN GEOSCIENCES

· Subject Méthodes mathématiques pour l'exploitation des données

Objectives

Illustrate different mathematical methods for analyzing and using data in geoscience

Targeted skills
* Recognize the different possible sources of uncertainty in environmental modeling
* Identify and use methodologies for estimation and propagation of uncertainty
* Describe the practical applications of data assimilation in the environment
* Recognize an overall method for data assimilation and experimentation

Description

Part 1: Uncertainty Quantification

Part 2: Ensemble Methods for Data Assimilation

Person(s) in charge
ROUX Helene
Helene.Roux@imft.fr
Phone 2840

THUAL Olivier
Olivier.Thual@imft.fr
Phone 2945

ROUX HELENE

Teaching method
Hybride

Teaching language
French

· Subject Utilisation de l'intelligence artificielle en prévision

Objectives

Illustrate different possible uses of artificial intelligence methods for forecasting in geosciences

Targeted skills

* Identify and use classic learning methods
* Choose a method appropriate to a given objective

Description

Part 1: Machine learning for forecasting

Part 2: Neural networks for classification in geoscience

Person(s) in charge
CARLIER AXEL

Teaching method
Hybride

Teaching language
French

· Teaching Unit HYDROLOGIE

· Subject Hydrologie approfondie, bassin versant et milieu urbain

Objectives

Hydrology deals with that part of the hydrological cycle occurring around the earth surface. The hydrological cycle from precipitation to river discharge is considered, as well as the way human activity can influence water flows.

Targeted skills

- Distinguish the control processes of a given system:

  Watersheds

  Distribution system

  Urban drainage system

- Formalize this understanding into a system of mathematical relationships that provides a reliable prediction of the system

- Use this model for operational forecasts useful for structural design, management and decision making

Description

- Presentation of the "big" water cycle (Watershed hydrology)

  Interception

  Snowmelt

  Evapotranspiration

  Infiltration

  Hydrological response

  Surface runoff and water paths

- Presentation of the "small" water cycle (urban systems)

- Data collection and analysis issues

- Implementation of a hydrological model

- Theory and exercise based learning

Number of hours
35

Person(s) in charge
CASSAN Ludovic
Ludovic.Cassan@imft.fr
Phone 2971

ROUX Helene
Helene.Roux@imft.fr
Phone 2840

ROUX HELENE

Teaching method
En présence

Teaching language
French

· Subject Hydrologie Statistique (HSTA)

Objectives

Enhance hydrology skills using statistical and probabilistic approaches by example analysis and statistical modeling of rainfall-runoff processes, with methods of processing spatiotemporal data adapted to the problems of hydrology.

Description
* Univariate Statistical Analysis and Probability Law Adjustments
* Extreme variables (annual floods), project floods / rare events (Poisson's law).
* Multivariate statistical analysis, Bayesian estimation, multiple regression, correlation multiple, and Principal Component Analysis (PCA): applications to criticism,
* Reconstitution, and/or mapping of hydrological data.
* Statistical analysis of time series from measurement networks hydrometeorological and hydrogeological.
* Time correlation functions (delays). Statistical identification of the rainfall-flow relationship (P(t)==>(Qt)).
* Geostatistical estimation using the theory of regionalized variables and/or modeling of temporal hydrological variables treated as random processes (your choice) :case study that may vary from year to year).

Number of hours
17,5

Person(s) in charge
ABABOU RACHID

· Subject L'Eau en milieu urbain (EURB)

Person(s) in charge
DARTUS DENIS

· Subject Hydrologie des Transferts (HTRA)

Person(s) in charge
DEBENEST GERALD

· Teaching Unit MODELISATION HYDRAULIQUE AVANCEE

· Subject Systèmes d'Information Géographique (SIG)

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Person(s) in charge
MONTEIL CLAUDE

· Subject Modélisation Avancée des Ecoulements à Surface Libre (MAESL)

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Description

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Person(s) in charge
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Introduction to the physical processes of sediment transport by flows and methods estimating sedimentary fluxes and the resulting changes in the bottom.

Description

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17,5

Person(s) in charge
ASTRUC DOMINIQUE

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BONOMETTI THOMAS

· Teaching Unit TRANSITION ENERGETIQUE ET ENERGIES RENOUVELABLES

· Subject Transition énergétique et énergies renouvelables

Person(s) in charge
DURU PAUL

· Spécialité SEE-Aéro-BD - 3A MF2E

· Teaching Unit SOFT AND HUMAN SKILLS

Person(s) in charge
HULL ALEXANDRA

· Subject Professional English-LV1-Semestre 9

· Subject Anglais Scientifique

· Choix 2 Anglais Professionnel - 3A

Choice: 1 Among 1 :

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· Subject Anglais de Cambridge ou Projet

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Person(s) in charge
LAUVERGNIER FRANCOIS

· Subject Controverses dans un monde en transition (MF2E)

· Subject RSE (MF2E)

· Subject IT and Computer Law (SN)

· Subject Strategic and Critical Thinking (SN)

· Subject Bureau d'Etudes Industrielles (BEI/BEE)/Conférence

· Teaching Unit APPLICATIONS A L'AERODYNAMIQUE

Person(s) in charge
ALBAGNAC JULIE

· Subject Aérodynamique

Person(s) in charge
ALBAGNAC JULIE

· Subject Aéroacoustique

Person(s) in charge
PIOT ESTELLE

· Subject Interactions Fluide-Structure

Person(s) in charge
MOUGEL JEROME

· Teaching Unit INTELLIGENCE ARTIFICIELLE EN GEOSCIENCES

· Subject Méthodes mathématiques pour l'exploitation des données

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· Teaching Unit HYDROLOGIE

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Number of hours
17,5

Person(s) in charge
ABABOU RACHID

· Subject L'Eau en milieu urbain (EURB)

Person(s) in charge
DARTUS DENIS

· Subject Hydrologie des Transferts (HTRA)

Person(s) in charge
DEBENEST GERALD

· Teaching Unit MODELISATION HYDRAULIQUE AVANCEE

· Subject Systèmes d'Information Géographique (SIG)

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Number of hours
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Person(s) in charge
MONTEIL CLAUDE

· Subject Modélisation Avancée des Ecoulements à Surface Libre (MAESL)

Objectives

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Person(s) in charge
CASSAN LUDOVIC

· Subject Transport Sédimentaire et Morphodynamique (TSMO)

Objectives

Introduction to the physical processes of sediment transport by flows and methods estimating sedimentary fluxes and the resulting changes in the bottom.

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II. Local processes and morphodynamic models

III. Sediment properties

IV. Setting in motion

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VI. Transport modeling by suspension

VII. Multi-phase modelling approaches

Number of hours
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Person(s) in charge
ASTRUC DOMINIQUE

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Person(s) in charge
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· Teaching Unit TRANSITION ENERGETIQUE ET ENERGIES RENOUVELABLES

· Subject Transition énergétique et énergies renouvelables

Person(s) in charge
DURU PAUL

· Spécialité SEE-EE - 3A MF2E

· Teaching Unit SOFT AND HUMAN SKILLS

Person(s) in charge
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· Subject Professional English-LV1-Semestre 9

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Person(s) in charge
LAUVERGNIER FRANCOIS

· Subject Controverses dans un monde en transition (MF2E)

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* Thermodynamic Basis
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Person(s) in charge
PRAUD OLIVIER

· Teaching Unit HYDROLOGIE

· Subject Hydrologie approfondie, bassin versant et milieu urbain

Objectives

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Targeted skills

- Distinguish the control processes of a given system:

Watersheds

Distribution system

Urban drainage system

- Formalize this understanding into a system of mathematical relationships that provides a reliable prediction of the system

- Use this model for operational forecasts useful for structural design, management and decision making

Description

- Presentation of the "big" water cycle (Watershed hydrology)

Interception

Snowmelt

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Number of hours
35

Person(s) in charge
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Teaching method
En présence

Teaching language
French

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Objectives

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Number of hours
17,5

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Person(s) in charge
BONOMETTI THOMAS

· Teaching Unit TRANSITION ENERGETIQUE ET ENERGIES RENOUVELABLES

· Subject Transition énergétique et énergies renouvelables

Person(s) in charge
DURU PAUL

· Teaching Unit ECO ENERGIE

· Subject Eco Energie

· Spécialité SEE-Aéro-EE - 3A MF2E

· Teaching Unit SOFT AND HUMAN SKILLS

Person(s) in charge
HULL ALEXANDRA

· Subject Professional English-LV1-Semestre 9

· Subject Anglais Scientifique

· Choix 2 Anglais Professionnel - 3A

Choice: 1 Among 1 :

· Subject Anglais Clinique

· Subject Anglais de Cambridge ou Projet

· Subject Careers, Leadership & Management-S9

Choice: 2 Among 3 :

· Subject Conduite d'opération en hydraulique (MF2E)

Objectives

Give future engineers the notions and tools to be operational in project management, here applied to hydraulic engineering.

Description

- Project manager & company manager".

Role of each stakeholder. Regulatory files: authorization file, nomenclature of the law on water, relationship with the services of the Administration (DREAL, DDT, AFB ...). Schedule of operation.

- "The standardized missions of the project manager".

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- "Business Consultation "

Constitution of technical documents for consultation (CCTP, BP, DQE). Presentation of the repositories

(Eurocodes, fascicles, standards, GTR).

Person(s) in charge
LAUVERGNIER FRANCOIS

· Subject Controverses dans un monde en transition (MF2E)

· Subject RSE (MF2E)

· Subject IT and Computer Law (SN)

· Subject Strategic and Critical Thinking (SN)

· Subject Bureau d'Etudes Industrielles (BEI/BEE)/Conférence

· Teaching Unit APPLICATIONS A L'AERODYNAMIQUE

Person(s) in charge
ALBAGNAC JULIE

· Subject Aérodynamique

Person(s) in charge
ALBAGNAC JULIE

· Subject Aéroacoustique

Person(s) in charge
PIOT ESTELLE

· Subject Interactions Fluide-Structure

Person(s) in charge
MOUGEL JEROME

· Teaching Unit HYDROLOGIE

· Subject Hydrologie approfondie, bassin versant et milieu urbain

Objectives

Hydrology deals with that part of the hydrological cycle occurring around the earth surface. The hydrological cycle from precipitation to river discharge is considered, as well as the way human activity can influence water flows.

Targeted skills

- Distinguish the control processes of a given system:

  Watersheds

  Distribution system

  Urban drainage system

- Formalize this understanding into a system of mathematical relationships that provides a reliable prediction of the system

- Use this model for operational forecasts useful for structural design, management and decision making

Description

- Presentation of the "big" water cycle (Watershed hydrology)

  Interception

  Snowmelt

  Evapotranspiration

  Infiltration

  Hydrological response

  Surface runoff and water paths

- Presentation of the "small" water cycle (urban systems)

- Data collection and analysis issues

- Implementation of a hydrological model

- Theory and exercise based learning

Number of hours
35

Person(s) in charge
CASSAN Ludovic
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Phone 2971

ROUX Helene

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Phone 2840

ROUX HELENE

Teaching method
En présence

Teaching language
French

· Subject Hydrologie Statistique (HSTA)

Objectives

Enhance hydrology skills using statistical and probabilistic approaches by example analysis and statistical modeling of rainfall-runoff processes, with methods of processing spatiotemporal data adapted to the problems of hydrology.

Description
* Univariate Statistical Analysis and Probability Law Adjustments
* Extreme variables (annual floods), project floods / rare events (Poisson's law).
* Multivariate statistical analysis, Bayesian estimation, multiple regression, correlation multiple, and Principal Component Analysis (PCA): applications to criticism,
* Reconstitution, and/or mapping of hydrological data.
* Statistical analysis of time series from measurement networks hydrometeorological and hydrogeological.
* Time correlation functions (delays). Statistical identification of the rainfall-flow relationship (P(t)==>(Qt)).
* Geostatistical estimation using the theory of regionalized variables and/or modeling of temporal hydrological variables treated as random processes (your choice) :case study that may vary from year to year).

Number of hours
17,5

Person(s) in charge
ABABOU RACHID

· Subject L'Eau en milieu urbain (EURB)

Person(s) in charge
DARTUS DENIS

· Subject Hydrologie des Transferts (HTRA)

Person(s) in charge
DEBENEST GERALD

· Teaching Unit MODELISATION HYDRAULIQUE AVANCEE

· Subject Systèmes d'Information Géographique (SIG)

Objectives

These courses and tutorials are designed to introduce students to the principles of the Systems Information Geographic and their use.

Description

- Course: "Introduction to GIS

This course explains the fundamental principles of Geographic Information Systems. Course Outline:

Definition of a GIS, the components of a GIS (data, methods, human resources, etc.), the use of GIS and the use of GIS in the development of a GIS. and hardware), main functionalities, data representation mode (raster, vector),data structuring (storage models), repositories and cartographic projections (geoid, ellipsoid and geodetic systems), georeferencing. The different notions are illustrated in the tutorial framework.

Course: "Relief representation and digital terrain model".

This course provides an overview of the cartographic methods used to represent relief and exposes the theoretical basis for creating and manipulating digital terrain models (MNT). The concepts seen during the course are applied in the framework of tutorials.Course outline: Representation of the relief on a map (definition, side points, contour lines, etc.), special figures, illumination and fading, hypsometric tints). General characteristics of DTM (definition, mode of representation, principles of elaboration). Data sources for the construction of MNT. Interpolation methods: global interpolation method (area of trend), local interpolation methods (moving average,inverse distance weighting, overview of kriging). Information derived from DTMs: slope and orientation, flow direction (method D4 and D8), calculation of drained surfaces, extraction of watersheds and network hydrographic, topological description of the hydrographic network.

Contents of the TSTs :

Introduction to ArcGIS software (and Spatial Analyst and 3D analyst extensions) and Idrisi software.

1) Introduction to ArcGIS software functionalities

2) Georeferencing of a topographic map (Idrisi)

3) Creation and manipulation of DTM - spatial analysis in raster mode (ArcGIS)

4) Network management

5) Modelling and assessment of soil sensitivity to erosion at the regional scale in France (ArcGIS)

Number of hours
14 de TD

Person(s) in charge
MONTEIL CLAUDE

· Subject Modélisation Avancée des Ecoulements à Surface Libre (MAESL)

Objectives

Use advanced 1D and 2D free surface flow modeling software, taking into account the following accounts for sediment and pollutant transport

Description

- use of the software for solving the Saint-Venant equations 1D/2D HECRAS, TELEMAC

- use of sediment transport modules HECHMS, SISYPHE

- use of associated pre- and post-processing software (ArcGIS, BlueKenue, Fudaa, Paraview)

Person(s) in charge
CASSAN LUDOVIC

· Subject Transport Sédimentaire et Morphodynamique (TSMO)

Objectives

Introduction to the physical processes of sediment transport by flows and methods estimating sedimentary fluxes and the resulting changes in the bottom.

Description

I. Geomorphology of coastlines and rivers

II. Local processes and morphodynamic models

III. Sediment properties

IV. Setting in motion

V. Modeling of Carriage Transport

VI. Transport modeling by suspension

VII. Multi-phase modelling approaches

Number of hours
17,5

Person(s) in charge
ASTRUC DOMINIQUE

Bibliography

- Principles of Sediment Transport in Rivers, Estuaries and Coastal Seas, LC. Van Rijn 1990 Aqua Publications.

- Hydraulics of sediment transport, W.H. Graf 1984 Water Ressources Publications

· Subject Codes de calcul en environnement (MODE)

Person(s) in charge
BONOMETTI THOMAS

· Teaching Unit TRANSITION ENERGETIQUE ET ENERGIES RENOUVELABLES

· Subject Transition énergétique et énergies renouvelables

Person(s) in charge
DURU PAUL

· Teaching Unit ECO ENERGIE

· Subject Eco Energie

· Spécialité SEE-GE - 3A MF2E

· Teaching Unit Harmonisation

Choice: 3 Among 4 :

· Subject Chimie des solutions

· Subject Agro-écosystèmes

· Subject Hydraulique - introduction à l'hydrologie

Objectives

Basic concepts of steady-state or transient unidirectional flows

Introduction to usual softwares

Hydrological balance at a given scale

Targeted skills

To be able:

* to mobilize theoretical knowledge to build a numerical or theoretical model adapted to a given objective,
* to interpret the results from the modeling,
* to make a critical analysis of these results.

Description

Pipe flows:

* General principles of hydraulics
* Definition of a pressure flow systems
* Flow regimes
* Notions of linear / singular head losses
* Pipeline networks
* Pumps and turbines

Open channel flow:

* Engineering problems of free surface flows
* Stationary flow
* Hydraulic structures and singularities
* Equations of Saint-Venant
* Numerical modeling

Hydrological balance:

* What hydrological balance means?
* Estimation of rainfall volume
* Estimation of evapotranspiration
* Estimation of the volume of subsurface flows
* Estimation of the volume of surface flows

Person(s) in charge
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DARTUS Denis
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Phone 2006/2859

Teaching method
En présence

Teaching language
French

Bibliography

Bennis, S. (2009). Hydraulique et hydrologie, Presses de l'Université du Québec. Disponible en ligne : http://univ-toulouse.scholarvox.com/reader/index/docid/88801575/page/1

Lencastre, A. (1996). Hydraulique générale. Eyrolles.

Thual, O. (2010), 'Hydrodynamique de l'environnement', Éditions de l'École Poytechnique, 322 pp.

Thual, O. (2018), 'Hydraulique pour l'ingénieur généraliste', Cépaduès- Éditions, 115 pp.

· Subject SIG

· Teaching Unit Milieux naturels

· Teaching Unit Ingénierie et traitement des eaux

· Teaching Unit GE-Sciences humaines, sociales et juridiques

· Teaching Unit GE-Bureau d'études industrielles

· Teaching Unit GE - Modules optionnels

Choice: 1 Among 2 :

· Teaching Unit Ingenierie de l'aménagement

· Teaching Unit Ingenierie du développement soutenable

· Teaching Unit Impacts anthropiques

· Teaching Unit Hydrologie

· Sem.9 MF2E Parcours Fluides Energétique et Procédés (FEP)

Choice: 1 Among 1 :

· Spécialité FEP

· Teaching Unit SOFT AND HUMAN SKILLS

Person(s) in charge
HULL ALEXANDRA

· Subject Professional English-LV1-Semestre 9

· Subject Anglais Scientifique

· Choix 2 Anglais Professionnel - 3A

Choice: 1 Among 1 :

· Subject Anglais Clinique

· Subject Anglais de Cambridge ou Projet

· Subject Careers, Leadership & Management-S9

Choice: 2 Among 3 :

· Subject Conduite d'opération en hydraulique (MF2E)

Objectives

Give future engineers the notions and tools to be operational in project management, here applied to hydraulic engineering.

Description

- Project manager & company manager".

Role of each stakeholder. Regulatory files: authorization file, nomenclature of the law on water, relationship with the services of the Administration (DREAL, DDT, AFB ...). Schedule of operation.

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Constitution of technical documents for consultation (CCTP, BP, DQE). Presentation of the repositories

(Eurocodes, fascicles, standards, GTR).

Person(s) in charge
LAUVERGNIER FRANCOIS

· Subject Controverses dans un monde en transition (MF2E)

· Subject RSE (MF2E)

· Subject IT and Computer Law (SN)

· Subject Strategic and Critical Thinking (SN)

· Subject Bureau d'Etudes Industrielles (BEI/BEE)/Conférence

· Choix Harmonisation

Choice: 1 Among 1 :

· Teaching Unit HARMONISATION A7

· Subject Initiation Linux/Harm.A7

· Subject Rappels de MkF et Initiation à la turbulence (MFIT)/Harm. A7

Pre-requisites

Basic knowledge on differential operators and matrices

Mass and momentum balances in fluids mechanics

Objectives

Reminder on local balances in fluids mechanics (mass and momentum balances)

Description of the transition to turbulence.

Write Navier-Stokes equations with Reynolds averaging.

Obtain the profile mean velocity in a turbulent channel

Targeted skills

Writing and simplification of Navier-Stokes equations

Description of turbulence and instabilities of flows

Solutions of Navier-Stokes equations for simplified geometries

Description

Differential operators and calculation with matrices

Navier-Stokes equations in cartesian, cylindrical, spherical coordinates

Couette and Poiseuille laminar flows

Transition to turbulence

Navier-Stokes equations with Reynolds averaging

Turbulent channel flow and Prandtl model

Number of hours
10 hours

Person(s) in charge
CLIMENT ERIC

· Subject Dynamique des bulles, gouttes et particules (DBGP) / Harm.A7

Person(s) in charge
LEGENDRE DOMINIQUE

· Teaching Unit HARMONISATION N7

· Subject Transfert de matière

Person(s) in charge
HEMATI MEHRDJI

· Subject Dimensionnement de réacteur (DIMRAC)

Person(s) in charge
BILLET ANNE MARIE

· Teaching Unit TURBULENCE ET ECOULEMENTS MULTIPHASES

· Subject Physique des écoulements turbulents incompressibles (PHET)

Person(s) in charge
PRAUD OLIVIER

· Subject Ecoulements Disphasiques (DIPH)

Person(s) in charge
LEGENDRE DOMINIQUE

· Subject Transferts en Milieux disphasiques et turbulents (TMRC)

Person(s) in charge
MAGNAUDET JACQUES

· Teaching Unit TRANSITION ENERGETIQUE ET ENERGIES RENOUVELABLES

· Subject Transition énergétique et énergies renouvelables

Person(s) in charge
DURU PAUL

· Teaching Unit PARTICULES ET TRANSFERTS

Person(s) in charge
BONOMETTI THOMAS

· Subject Ecoulements gaz-particules (ECGP)

Pre-requisites

Modelling of transport and transfers in single-phase laminar, anisothermal and reactive flows

Turbulent dispersion and mixing (temporal and spatial scales of turbulence, turbulent viscosity, turbulent dispersion)

Introduction to statistical modelling (multivariate probability density, normal distribution)

Knowledge of the kinetic theory of diluted gases is recommended.

Objectives

Introduction to mathematical modelling and numerical simulation approaches developed for gas-particle reactive flows in dense or dilute regime encountered in the industrial fields of energy, transport and process engineering, but also in the fields of health and the environment.

Qualitative presentation of gas-particle flows encountered in the fields of transport, energy, process, health and environment, and the challenges of modelling, based mainly on the teacher's industrial partnership activities.

Introduction of the macroscopic parameters characterising this type of flow: temperature, pressure, particle diameter, mass density, volume fraction, numerical density, mass load, etc.

Targeted skills

Expertise in the methodological approaches to be implemented for the numerical simulation of reactive gas-particle flows at different scales.

Ability to critically analyse the modelling hypotheses used in the commercial simulation tools for multiphase flows implemented in industrial research teams or design offices.

Introduction to the research and development of mathematical modelling and numerical simulation of reactive gas-particle flows.

Description

Introduction

Qualitative presentation of the phenomena and issues involved in modelling gas-particle flows encountered in the fields of transport, energy, process, health and environment, based mainly on the teacher's industrial partnership activities.

Introduction of the macroscopic parameters characterising this type of flows: temperature, pressure, particle diameter, mass density, volume fraction, numerical density, mass load, etc.

General presentation of the mathematical modelling and numerical simulation methods for dispersed phase flows and their multi-scale articulation by analogy with the kinetic theory of gases: direct or fully resolved simulation on a small scale, deterministic Euler-Lagrange modelling on a mesoscale, statistical modelling and methods of moments (or N-fluid model) on a macro scale.

Deterministic Lagrangian modelling of particles

- Momentum equation and modelling of fluid-particle (drag, Archimedean, jet propulsion) and particle-particle (collision) transfers in dense and dilute regimes.

- Enthalpy equation and modelling of fluid-particle transfers (thermal diffusion and mass transfer).

- Mass equation and modelling of fluid-particle transfers (evaporation/condensation of droplets, pyrolysis and gasification of biomass, heterogeneous catalysis reaction) and particle-particle (coalescence, break-up and attrition).

Statistical modelling of particle clouds

Introduction of the joint distribution function of velocity, mass and enthalpy for a particle ensemble, and of the corresponding averaging operator.

Writing of the Liouville equation (or kinetic or Boltzmann-type) which governs the distribution function.

Closure of this equation in connection with the Lagrangian deterministic modelling of fluid-particle and particle-particle transfers. Semi-empirical introduction of the BGK model for the representation of the effect of collisions between elastic particles.

Macroscopic modelling of particulate flow

Definition of the moments of the particulate phase (numerical density, mean mass, mean velocity, random kinetic energy, mean temperature, kinetic stress tensor, etc.).

General introduction to the method of deriving macroscopic equations from the Liouville equation. Reformulation of the collision term as the sum of a pair modification source term and a collision flow term.

Application to mass balance, numerical density balance and momentum balance equations. Analysis of closure problems and proposal of models: fluid-to-particle mass transfer, mixing of particle species and coalescence, fluid-to-particle momentum transfer (fluid-to-particle turbulent drift velocity) and introduction of kinetic and collisional viscosities.

Application

The exam consists of a work carried out for about 4 hours with the help of the teacher in charge. The aim of this work is to study a real gas-particle flow configuration and to apply the skills acquired in the course to the modelling and simulation of these flows. For example, this could be the application of the course to the modelling of a dust storm or the de-nebulization of fog at an airport.

Number of hours
35

Person(s) in charge
SIMONIN Olivier
olivier.simonin@inp-toulouse.fr
Phone 2901

SIMONIN OLIVIER

· Subject Transferts en milieux poreux (MIPO)

Person(s) in charge
LIOT OLIVIER

· Subject Milieux granulaires (MGRA)

Person(s) in charge
BONOMETTI THOMAS

· Teaching Unit SIMULATIONS NUMERIQUES - FLUIDE PARTICULES

Person(s) in charge
ESTIVALEZES JEAN-LUC

· Subject Modèles de Turbulence p/Simulations num. Stationnaires(MTSS)

Person(s) in charge
ESTIVALEZES JEAN-LUC

· Subject Simulation des écoulements industriels (CODC)

Pre-requisites

CFD Tools basic and advanced

fluid mechanics knowledge

Thermal transport

Porous media

Objectives

Deepen knowledge of a computational code by putting yourself in complex situations both in terms of mesh and turbulence model. The modeling of three-dimensional situations is highlighted.

Analyzing a flow situation

Determine conditions at limits by interpreting numerical results

offer adapted transport models

compare its results to theoretical predictions

Targeted skills

Implement numerical tools to represent a complex and coupled flow situation

Analyze and criticize selected approaches

To process and compare results through the use of post-processing tools tailored to the expectations of the literature

Person(s) in charge

DEBENEST GERALD

Teaching method
En présence

Teaching language
English and french

Bibliography

Debenest G.; Mourzenko V.V.; Thovert J-F. (2005), Smouldering in fixed beds of oil shale grains: governing parameters and global regimes, Combustion Theory and Modelling, Vol. 2, pp. 301-321

· Subject Simulation d'un lit fluidisé (NEPT)

Person(s) in charge
NEAU HERVE

· Teaching Unit MILIEUX REACTIFS

Person(s) in charge
BAZILE RUDY

· Subject Combustion (COMB)

Person(s) in charge
POINOT THIERRY

· Subject BES Moteurs à pistons (BESM)

Person(s) in charge
BAZILE RUDY

· Spécialité FEP-Proc

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· Teaching Unit TRANSITION ENERGETIQUE ET ENERGIES RENOUVELABLES

· Subject Transition énergétique et énergies renouvelables

Person(s) in charge
DURU PAUL

· Teaching Unit PROCESSUS : PHYSIQUE ET MODELISATION

Person(s) in charge

DURU PAUL

· Subject Microprocédés et microéchangeurs (MICRO)

Person(s) in charge
TORDJEMAN PHILIPPE

· Subject Agitation - Mélange (AGIT)

Person(s) in charge
XUEREB CATHERINE

· Subject PhysicoChemical hydromatics : colloidal susp. (PhyCosep)

Person(s) in charge
DURU PAUL

· Subject Thermodynaiques des turbines à vapeur (THERM)

Person(s) in charge
ROIG VERONIQUE

· Teaching Unit PARTICULES ET TRANSFERTS

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BONOMETTI THOMAS

· Teaching Unit SIMULATIONS NUMERIQUES - FLUIDE PARTICULES

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· Subject Modèles de Turbulence p/Simulations num. Stationnaires(MTSS)

Person(s) in charge
ESTIVALEZES JEAN-LUC

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Determine conditions at limits by interpreting numerical results

offer adapted transport models

compare its results to theoretical predictions

Targeted skills

Implement numerical tools to represent a complex and coupled flow situation

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DEBENEST GERALD

Teaching method
En présence

Teaching language
English and french

Bibliography

Debenest G.; Mourzenko V.V.; Thovert J-F. (2005), Smouldering in fixed beds of oil shale grains: governing parameters and global regimes, Combustion Theory and Modelling, Vol. 2, pp. 301-321

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Person(s) in charge
NEAU HERVE

· Spécialité FEP-FEIP

· Teaching Unit SOFT AND HUMAN SKILLS

Person(s) in charge
HULL ALEXANDRA

· Subject Professional English-LV1-Semestre 9

· Subject Anglais Scientifique

· Choix 2 Anglais Professionnel - 3A

Choice: 1 Among 1 :

· Subject Anglais Clinique

· Subject Anglais de Cambridge ou Projet

· Subject Careers, Leadership & Management-S9

Choice: 2 Among 3 :

· Subject Conduite d'opération en hydraulique (MF2E)

Objectives

Give future engineers the notions and tools to be operational in project management, here applied to hydraulic engineering.

Description

- Project manager & company manager".

Role of each stakeholder. Regulatory files: authorization file, nomenclature of the law on water, relationship with the services of the Administration (DREAL, DDT, AFB ...). Schedule of operation.

- "The standardized missions of the project manager".

APS, AVP, PRO, DCE, VISA, DET, OPR.

- "Business Consultation "

Constitution of technical documents for consultation (CCTP, BP, DQE). Presentation of the repositories

(Eurocodes, fascicles, standards, GTR).

Person(s) in charge
LAUVERGNIER FRANCOIS

· Subject Controverses dans un monde en transition (MF2E)

· Subject RSE (MF2E)

· Subject IT and Computer Law (SN)

· Subject Strategic and Critical Thinking (SN)

· Subject Bureau d'Etudes Industrielles (BEI/BEE)/Conférence

· Choix Harmonisation

Choice: 1 Among 1 :

· Teaching Unit HARMONISATION A7

· Subject Initiation Linux/Harm.A7

· Subject Rappels de MkF et Initiation à la turbulence (MFIT)/Harm. A7

Pre-requisites

Basic knowledge on differential operators and matrices

Mass and momentum balances in fluids mechanics

Objectives

Reminder on local balances in fluids mechanics (mass and momentum balances)

Description of the transition to turbulence.

Write Navier-Stokes equations with Reynolds averaging.

Obtain the profile mean velocity in a turbulent channel

Targeted skills

Writing and simplification of Navier-Stokes equations

Description of turbulence and instabilities of flows

Solutions of Navier-Stokes equations for simplified geometries

Description

Differential operators and calculation with matrices

Navier-Stokes equations in cartesian, cylindrical, spherical coordinates

Couette and Poiseuille laminar flows

Transition to turbulence

Navier-Stokes equations with Reynolds averaging

Turbulent channel flow and Prandtl model

Number of hours
10 hours

Person(s) in charge
CLIMENT ERIC

· Subject Dynamique des bulles, gouttes et particules (DBGP) / Harm.A7

Person(s) in charge
LEGENDRE DOMINIQUE

· Teaching Unit HARMONISATION N7

· Subject Transfert de matière

Person(s) in charge
HEMATI MEHRDJI

· Subject Dimensionnement de réacteur (DIMRAC)

Person(s) in charge
BILLET ANNE MARIE

· Teaching Unit TURBULENCE ET ECOULEMENTS MULTIPHASES

· Subject Physique des écoulements turbulents incompressibles (PHET)

Person(s) in charge
PRAUD OLIVIER

· Subject Ecoulements Disphasiques (DIPH)

Person(s) in charge
LEGENDRE DOMINIQUE

· Subject Transferts en Milieux disphasiques et turbulents (TMRC)

Person(s) in charge
MAGNAUDET JACQUES

· Teaching Unit TRANSITION ENERGETIQUE ET ENERGIES RENOUVELABLES

· Subject Transition énergétique et énergies renouvelables

Person(s) in charge
DURU PAUL

· Teaching Unit PROCEDES ECOULEMENTS MULTIPHASES

Person(s) in charge
ROIG VERONIQUE

· Subject Ecoulements disphasiques avec changements de phase (CHPH)

Person(s) in charge
COLIN CATHERINE

· Subject Hydraulique diphasique (HYDI)

Person(s) in charge
ROIG VERONIQUE

· Subject Coalescence Rupture Agrégation (CORA)

Person(s) in charge
LALANNE BENJAMIN

· Teaching Unit SIMULATIONS NUMERIQUES : PROCESSUS

Person(s) in charge
ESTIVALEZES JEAN-LUC

· Subject Modèles de Turbulence p/Simulations num. Stationnaires(MTSS)

Person(s) in charge
ESTIVALEZES JEAN-LUC

· Subject Numérique Disphasique (LECA)

Person(s) in charge
LIOT OLIVIER

· Subject Simulation des écoulements industriels (CODC)

Pre-requisites

CFD Tools basic and advanced

fluid mechanics knowledge

Thermal transport

Porous media

Objectives

Deepen knowledge of a computational code by putting yourself in complex situations both in terms of mesh and turbulence model. The modeling of three-dimensional situations is highlighted.

Analyzing a flow situation

Determine conditions at limits by interpreting numerical results

offer adapted transport models

compare its results to theoretical predictions

Targeted skills

Implement numerical tools to represent a complex and coupled flow situation

Analyze and criticize selected approaches

To process and compare results through the use of post-processing tools tailored to the expectations of the literature

Person(s) in charge
DEBENEST GERALD

Teaching method
En présence

Teaching language
English and french

Bibliography

Debenest G.; Mourzenko V.V.; Thovert J-F. (2005), Smouldering in fixed beds of oil shale grains: governing parameters and global regimes, Combustion Theory and Modelling, Vol. 2, pp. 301-321

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· Teaching Unit PROCESSUS : PHYSIQUE ET MODELISATION

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· Subject Microprocédés et microéchangeurs (MICRO)

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· Subject Agitation - Mélange (AGIT)

Person(s) in charge
XUEREB CATHERINE

· Subject PhysicoChemical hydromatics : colloidal susp. (PhyCosep)

Person(s) in charge
DURU PAUL

· Subject Thermodynaiques des turbines à vapeur (THERM)

Person(s) in charge
ROIG VERONIQUE

· Spécialité FEP-FEIP-Comb

· Teaching Unit SOFT AND HUMAN SKILLS

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Description

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Transition to turbulence

Navier-Stokes equations with Reynolds averaging

Turbulent channel flow and Prandtl model

Number of hours
10 hours

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Person(s) in charge
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ESTIVALEZES JEAN-LUC

· Subject Numérique Disphasique (LECA)

Person(s) in charge
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· Subject Simulation des écoulements industriels (CODC)

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Thermal transport

Porous media

Objectives

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Person(s) in charge
DEBENEST GERALD

Teaching method
En présence

Teaching language
English and french

Bibliography

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Person(s) in charge
LALANNE BENJAMIN

· Teaching Unit MILIEUX REACTIFS

Person(s) in charge
BAZILE RUDY

· Subject Combustion (COMB)

Person(s) in charge
POINOT THIERRY

· Subject BES Moteurs à pistons (BESM)

Person(s) in charge
BAZILE RUDY

· Spécialité FEP-Aéro

· Teaching Unit SOFT AND HUMAN SKILLS

Person(s) in charge
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- Project manager & company manager".

Role of each stakeholder. Regulatory files: authorization file, nomenclature of the law on water, relationship with the services of the Administration (DREAL, DDT, AFB ...). Schedule of operation.

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- "Business Consultation "

Constitution of technical documents for consultation (CCTP, BP, DQE). Presentation of the repositories

(Eurocodes, fascicles, standards, GTR).

Person(s) in charge
LAUVERGNIER FRANCOIS

· Subject Controverses dans un monde en transition (MF2E)

· Subject RSE (MF2E)

· Subject IT and Computer Law (SN)

· Subject Strategic and Critical Thinking (SN)

· Subject Bureau d'Etudes Industrielles (BEI/BEE)/Conférence

· Choix Harmonisation

Choice: 1 Among 1 :

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· Subject Initiation Linux/Harm.A7

· Subject Rappels de MkF et Initiation à la turbulence (MFIT)/Harm. A7

Pre-requisites

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Objectives

Reminder on local balances in fluids mechanics (mass and momentum balances)

Description of the transition to turbulence.

Write Navier-Stokes equations with Reynolds averaging.

Obtain the profile mean velocity in a turbulent channel

Targeted skills

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Description of turbulence and instabilities of flows

Solutions of Navier-Stokes equations for simplified geometries

Description

Differential operators and calculation with matrices

Navier-Stokes equations in cartesian, cylindrical, spherical coordinates

Couette and Poiseuille laminar flows

Transition to turbulence

Navier-Stokes equations with Reynolds averaging

Turbulent channel flow and Prandtl model

Number of hours
10 hours

Person(s) in charge
CLIMENT ERIC

· Subject Dynamique des bulles, gouttes et particules (DBGP) / Harm.A7

Person(s) in charge
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· Teaching Unit HARMONISATION N7

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· Subject Dimensionnement de réacteur (DIMRAC)

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BILLET ANNE MARIE

· Teaching Unit APPLICATIONS A L'AERODYNAMIQUE

Person(s) in charge
ALBAGNAC JULIE

· Subject Aérodynamique

Person(s) in charge
ALBAGNAC JULIE

· Subject Aéroacoustique

Person(s) in charge
PIOT ESTELLE

· Subject Interactions Fluide-Structure

Person(s) in charge
MOUGEL JEROME

· Teaching Unit TRANSITION ENERGETIQUE ET ENERGIES RENOUVELABLES

· Subject Transition énergétique et énergies renouvelables

Person(s) in charge
DURU PAUL

· Teaching Unit PARTICULES ET TRANSFERTS

Person(s) in charge
BONOMETTI THOMAS

· Subject Ecoulements gaz-particules (ECGP)

Pre-requisites

Modelling of transport and transfers in single-phase laminar, anisothermal and reactive flows

Turbulent dispersion and mixing (temporal and spatial scales of turbulence, turbulent viscosity, turbulent dispersion)

Introduction to statistical modelling (multivariate probability density, normal distribution)

Knowledge of the kinetic theory of diluted gases is recommended.

Objectives

Introduction to mathematical modelling and numerical simulation approaches developed for gas-particle reactive flows in dense or dilute regime encountered in the industrial fields of energy, transport and process engineering, but also in the fields of health and the environment.

Qualitative presentation of gas-particle flows encountered in the fields of transport, energy, process, health and environment, and the challenges of modelling, based mainly on the teacher's industrial partnership activities.

Introduction of the macroscopic parameters characterising this type of flow: temperature, pressure, particle diameter, mass density, volume fraction, numerical density, mass load, etc.

Targeted skills

Expertise in the methodological approaches to be implemented for the numerical simulation of reactive gas-particle flows at different scales.

Ability to critically analyse the modelling hypotheses used in the commercial simulation tools for multiphase flows implemented in industrial research teams or design offices.

Introduction to the research and development of mathematical modelling and numerical simulation of reactive gas-particle flows.

Description

Introduction

Qualitative presentation of the phenomena and issues involved in modelling gas-particle flows encountered in the fields of transport, energy, process, health and environment, based mainly on the teacher's industrial partnership activities.

Introduction of the macroscopic parameters characterising this type of flows: temperature, pressure, particle diameter, mass density, volume fraction, numerical density, mass load, etc.

General presentation of the mathematical modelling and numerical simulation methods for dispersed phase flows and their multi-scale articulation by analogy with the kinetic theory of gases: direct or fully resolved simulation on a small scale, deterministic Euler-Lagrange modelling on a mesoscale, statistical modelling and methods of moments (or N-fluid model) on a macro scale.

Deterministic Lagrangian modelling of particles

- Momentum equation and modelling of fluid-particle (drag, Archimedean, jet propulsion) and particle-particle (collision) transfers in dense and dilute regimes.

- Enthalpy equation and modelling of fluid-particle transfers (thermal diffusion and mass transfer).

- Mass equation and modelling of fluid-particle transfers (evaporation/condensation of droplets, pyrolysis and gasification of biomass, heterogeneous catalysis reaction) and particle-particle (coalescence, break-up and attrition).

Statistical modelling of particle clouds

Introduction of the joint distribution function of velocity, mass and enthalpy for a particle ensemble, and of the corresponding averaging operator.

Writing of the Liouville equation (or kinetic or Boltzmann-type) which governs the distribution function.

Closure of this equation in connection with the Lagrangian deterministic modelling of fluid-particle and particle-particle transfers. Semi-empirical introduction of the BGK model for the representation of the effect of collisions between elastic particles.

Macroscopic modelling of particulate flow

Definition of the moments of the particulate phase (numerical density, mean mass, mean velocity, random kinetic energy, mean temperature, kinetic stress tensor, etc.).

General introduction to the method of deriving macroscopic equations from the Liouville equation. Reformulation of the collision term as the sum of a pair modification source term and a collision flow term.

Application to mass balance, numerical density balance and momentum balance equations. Analysis of closure problems and proposal of models: fluid-to-particle mass transfer, mixing of particle species and coalescence, fluid-to-particle momentum transfer (fluid-to-particle turbulent drift velocity) and introduction of kinetic and collisional viscosities.

Application

The exam consists of a work carried out for about 4 hours with the help of the teacher in charge. The aim of this work is to study a real gas-particle flow configuration and to apply the skills acquired in the course to the modelling and simulation of these flows. For example, this could be the application of the course to the modelling of a dust storm or the de-nebulization of fog at an airport.

Number of hours
35

Person(s) in charge
SIMONIN Olivier
olivier.simonin@inp-toulouse.fr
Phone 2901

SIMONIN OLIVIER

· Subject Transferts en milieux poreux (MIPO)

Person(s) in charge
LIOT OLIVIER

· Subject Milieux granulaires (MGRA)

Person(s) in charge
BONOMETTI THOMAS

· Teaching Unit SIMULATIONS NUMERIQUES - FLUIDE PARTICULES

Person(s) in charge
ESTIVALEZES JEAN-LUC

· Subject Modèles de Turbulence p/Simulations num. Stationnaires(MTSS)

Person(s) in charge
ESTIVALEZES JEAN-LUC

· Subject Simulation des écoulements industriels (CODC)

Pre-requisites

CFD Tools basic and advanced

fluid mechanics knowledge

Thermal transport

Porous media

Objectives

Deepen knowledge of a computational code by putting yourself in complex situations both in terms of mesh and turbulence model. The modeling of three-dimensional situations is highlighted.

Analyzing a flow situation

Determine conditions at limits by interpreting numerical results

offer adapted transport models

compare its results to theoretical predictions

Targeted skills

Implement numerical tools to represent a complex and coupled flow situation

Analyze and criticize selected approaches

To process and compare results through the use of post-processing tools tailored to the expectations of the literature

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DEBENEST GERALD

Teaching method
En présence

Teaching language
English and french

Bibliography

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· Subject Simulation d'un lit fluidisé (NEPT)

Person(s) in charge
NEAU HERVE

· Teaching Unit MILIEUX REACTIFS

Person(s) in charge
BAZILE RUDY

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Person(s) in charge
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Porous media

Objectives

Deepen knowledge of a computational code by putting yourself in complex situations both in terms of mesh and turbulence model. The modeling of three-dimensional situations is highlighted.

Analyzing a flow situation

Determine conditions at limits by interpreting numerical results

offer adapted transport models

compare its results to theoretical predictions

Targeted skills

Implement numerical tools to represent a complex and coupled flow situation

Analyze and criticize selected approaches

To process and compare results through the use of post-processing tools tailored to the expectations of the literature

Person(s) in charge
DEBENEST GERALD

Teaching method
En présence

Teaching language
English and french

Bibliography

Debenest G.; Mourzenko V.V.; Thovert J-F. (2005), Smouldering in fixed beds of oil shale grains: governing parameters and global regimes, Combustion Theory and Modelling, Vol. 2, pp. 301-321

· Subject Simulation d'un lit fluidisé (NEPT)

Person(s) in charge
NEAU HERVE

· Spécialité FEP-FEIP-Aéro

· Teaching Unit SOFT AND HUMAN SKILLS

Person(s) in charge
HULL ALEXANDRA

· Subject Professional English-LV1-Semestre 9

· Subject Anglais Scientifique

· Choix 2 Anglais Professionnel - 3A

Choice: 1 Among 1 :

· Subject Anglais Clinique

· Subject Anglais de Cambridge ou Projet

· Subject Careers, Leadership & Management-S9

Choice: 2 Among 3 :

· Subject Conduite d'opération en hydraulique (MF2E)

Objectives

Give future engineers the notions and tools to be operational in project management, here applied to hydraulic engineering.

Description

- Project manager & company manager".

Role of each stakeholder. Regulatory files: authorization file, nomenclature of the law on water, relationship with the services of the Administration (DREAL, DDT, AFB ...). Schedule of operation.

- "The standardized missions of the project manager".

APS, AVP, PRO, DCE, VISA, DET, OPR.

- "Business Consultation "

Constitution of technical documents for consultation (CCTP, BP, DQE). Presentation of the repositories

(Eurocodes, fascicles, standards, GTR).

Person(s) in charge
LAUVERGNIER FRANCOIS

· Subject Controverses dans un monde en transition (MF2E)

· Subject RSE (MF2E)

· Subject IT and Computer Law (SN)

· Subject Strategic and Critical Thinking (SN)

· Subject Bureau d'Etudes Industrielles (BEI/BEE)/Conférence

· Choix Harmonisation

Choice: 1 Among 1 :

· Teaching Unit HARMONISATION A7

· Subject Initiation Linux/Harm.A7

· Subject Rappels de MkF et Initiation à la turbulence (MFIT)/Harm. A7

Pre-requisites

Basic knowledge on differential operators and matrices

Mass and momentum balances in fluids mechanics

Objectives

Reminder on local balances in fluids mechanics (mass and momentum balances)

Description of the transition to turbulence.

Write Navier-Stokes equations with Reynolds averaging.

Obtain the profile mean velocity in a turbulent channel

Targeted skills

Writing and simplification of Navier-Stokes equations

Description of turbulence and instabilities of flows

Solutions of Navier-Stokes equations for simplified geometries

Description

Differential operators and calculation with matrices

Navier-Stokes equations in cartesian, cylindrical, spherical coordinates

Couette and Poiseuille laminar flows

Transition to turbulence

Navier-Stokes equations with Reynolds averaging

Turbulent channel flow and Prandtl model

Number of hours
10 hours

Person(s) in charge
CLIMENT ERIC

· Subject Dynamique des bulles, gouttes et particules (DBGP) / Harm.A7

Person(s) in charge
LEGENDRE DOMINIQUE

· Teaching Unit HARMONISATION N7

· Subject Transfert de matière

Person(s) in charge
HEMATI MEHRDJI

· Subject Dimensionnement de réacteur (DIMRAC)

Person(s) in charge
BILLET ANNE MARIE

· Teaching Unit APPLICATIONS A L'AERODYNAMIQUE

Person(s) in charge
ALBAGNAC JULIE

· Subject Aérodynamique

Person(s) in charge
ALBAGNAC JULIE

· Subject Aéroacoustique

Person(s) in charge
PIOT ESTELLE

· Subject Interactions Fluide-Structure

Person(s) in charge
MOUGEL JEROME

· Teaching Unit TRANSITION ENERGETIQUE ET ENERGIES RENOUVELABLES

· Subject Transition énergétique et énergies renouvelables

Person(s) in charge
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Person(s) in charge
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Person(s) in charge
COLIN CATHERINE

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Person(s) in charge
ROIG VERONIQUE

· Subject Coalescence Rupture Agrégation (CORA)

Person(s) in charge
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· Teaching Unit SIMULATIONS NUMERIQUES : PROCESSUS

Person(s) in charge
ESTIVALEZES JEAN-LUC

· Subject Modèles de Turbulence p/Simulations num. Stationnaires(MTSS)

Person(s) in charge
ESTIVALEZES JEAN-LUC

· Subject Numérique Disphasique (LECA)

Person(s) in charge
LIOT OLIVIER

· Subject Simulation des écoulements industriels (CODC)

Pre-requisites

CFD Tools basic and advanced

fluid mechanics knowledge

Thermal transport

Porous media

Objectives

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Teaching method
En présence

Teaching language
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· Subject Couplage multiphysique (COMUL)

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· Subject Microprocédés et microéchangeurs (MICRO)

Person(s) in charge
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· Subject Agitation - Mélange (AGIT)

Person(s) in charge
XUEREB CATHERINE

· Subject PhysicoChemical hydromatics : colloidal susp. (PhyCosep)

Person(s) in charge
DURU PAUL

· Subject Thermodynaiques des turbines à vapeur (THERM)

Person(s) in charge
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Person(s) in charge
LALANNE BENJAMIN

· Teaching Unit MILIEUX REACTIFS

Person(s) in charge
BAZILE RUDY

· Subject Combustion (COMB)

Person(s) in charge
POINOT THIERRY

· Subject BES Moteurs à pistons (BESM)

Person(s) in charge
BAZILE RUDY

· Choix de Parc. Semestre 10 - 3A MF2E

Choice: 1 Among 1 :

· Semestre 10 à l'N7-3A-MF2E

Choice: 1 Among 1 :

· Teaching Unit PROJET FIN D'ETUDES MF2E SANS PROJET LONG

· Teaching Unit PFE MF2E avec PL

· **Teaching Unit PROJET LONG MF2E**

· **Teaching Unit PROJET DE FIN D'ETUDE-MF2E**

Organizational unit

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