

INVERSE PROBLEMS



ECTS
5 credits



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

In brief

➤ **Code:** N9EN21

Presentation

Objectives

The objectives of this course is to learn and understand various way to solve inverse problems. Depending on the student's area, applications will be oriented toward photographic 3D-reconstruction methods or numerical problems with uncertainty. In the first, case, the problem is to obtain a 3D model of a scene i.e., its shape and its colour. In the second case, the main filtering methods based on the non-linear Bayesian filters (particle filter, Kalman filter, extended Kalman filter, ensemble Kalman filter) will be studied. For a given ODE/SDE, students have to identify the corresponding notion of integration, then should be able to propose an adapted filtering method.

Description

The content is twofold, with a focus on the student's preferred area:

- Filtering methods

- Introduction to filtering : Bayesian inference ; Filtering and smoothing principles, non-linear filtering ; Application to the linear and Gaussian case: Kalman filter.

- Uncertainty dynamics for ordinary differential equations (ODE) and stochastic differential equations (SDE): from partial differential equation to ODE (numerical schemes); Lyapunov exponent and chaotic system; stochastic processes; discrete/continuous Markov processes; Observable/measure dynamics duality

- Stochastic filtering: Particle filter; Ensemble Kalman filter; Stochastic smoother

Pre-requisites

Optimization, notion of probability and statistics, numerical linear algebra

Useful info

Place

➤ Toulouse