Beyond the model

ECTS credits
3 credits

In brief

Course langage: French

Presentation

Prerequisites

Mathematics: probability/statistics

Learning objectives

- Understand and analyze the inherent limitations of each model.
- Be able to detect situations in which a model no longer seems to be appropriate.
- Know how to analyze and control a complex system without using a model

At a more general level, this UE aims to provide students with the skills and knowledge to become aware of the limits of modeling complex systems.

Description of the programme

Trend modeling, uncertainty quantification and sensitivity analysis (10 hrs : 5-3-2-0)
- Multiple regression: linear and nonparametric methods
- Trend modeling: Holt-Winters, ARMA, ARIMA, ...
- Quantification of uncertainties: parametric and non-parametric methods, small samples (quick mention of Bayesian methods, Wilks, ...)
- Sensitivity analysis: local methods, global methods (GSA) monotonic, non-monotonic, qualitative/quantitative (screening, variance decomposition).

Fuzzy control (16 h : 6-2-8-0)

Beyond the model

The modeling approach and its use to control a system can be difficult to implement if the system is too complex: the aim is therefore to present an alternative approach and, possibly, to compare them. In view of the examples of applications considered in S8, an approach based on fuzzy logic (absence of model of the complex system) is proposed to control the behavior of a complex system.

Limits of modeling. Scientific and technical, philosophical, cultural and political aspects (4 h : 4-0-0-0)
This module aims to highlight - from several multidisciplinary aspects - the limits of modeling and the always partial character of a model. This module is imagined as lectures given by experts from outside the School. Its exact content will depend on the invited speakers.

Generic central skills and knowledge targeted in the discipline

- Ability to invent creative, ingenious and original solutions.
- Ability to mobilize a scientific/technical culture (transdisciplinarity and/or specialization).
- Ability to understand and formulate the problem (hypotheses, orders of magnitude, etc.).
- Ability to propose one or more solution scenarios.

How knowledge is tested

CC1 : Trend modeling (project) 40
CC2 : Fuzzy control (report) 30
CC3 : Fuzzy control (program) 30

Bibliography

Handouts according to speaker

Teaching team

- Alain Kilidjian
- Nadia Pérot (CEA)

Total des heures		**30h**
CM	Master class	15h
TD	Directed work	5h
TP	Practical work	10h

Useful info

Name responsible for EU

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