Crisis management: physical and chemical applications

ECTS credits
4 credits

In brief

Course langage: French

Presentation

Prerequisites

Statistical physics Chemistry - Process engineering

Learning objectives

Know when and how to use the techniques and sciences of randomness, statistics and complexity. To illustrate these notions around applications of different kinds.
To open the mind, to have a certain mastery of the concepts of information sciences, physics, chemistry and which answer the problems posed. Make the link with the associated mathematical tools. To develop the desire to be an actor in the field. Develop a global vision.

Description of the programme

Track 1: Statistics, Information and Physics of complex systems. (CM 20 - TD 8 - TP 0 - TA 6)

Part A " Statistics, Information ":
- Recalls probability and classical statistical theory,
- Statistical theory of risk for decision or estimation,
- Elements of information theory,
- Complexity and applications.

Part B "Physics of complex systems":
- Phase transitions, Landau model and catastrophes,

- Percolation and fractals,
- Complex physical systems and application in information processing.

Part 2: Modeling of chemical and biological processes (2H CM + 10H TD + 4H TP)

When dimensioning industrial installations and evaluating their performance, it is necessary to have relevant models, making the right compromise between accuracy and simplicity. Unfortunately, chemical and biological processes are often subject to non-linear processes. With the help of several case studies, we will illustrate the proposal of judicious simplifications and the resolution of the resulting systems of equations (ODE, DAE, etc).

Generic central skills and knowledge targeted in the discipline

- Understand the usefulness of statistical tools for analyzing data from industrial, physical or management systems (C5)
- Understand the essential factors in complex systems (C2)
- Select a relevant method of solving a problem and critically evaluate the result (C2)

How knowledge is tested

Part 1 - Continuous assessment 2 Reports 2 x 35% = 70%.
Component 2 - Continuous assessment Personal work report 30%.

Bibliography

Ph. Réfrégier « Noise theory and application to physics » - Springer 2003.
P.H. Garthwaite, I.T. Jolliffe and B. Jones « Statistical Inference » - Prentice Hall 1995.
T.M. Cover and J.A. Thomas « Elements of information theory» - Wiley 2006.
D. Stauffer, H.E. Stanley, A. Lesne « Cours de Physique : De Newton à Mandelbrot » – Springer 1999.

Teaching team

- Nelson Ibaseta
- Philippe Réfrégier

Total des heures		**50h**
CM	Master class	23h
TD	Directed work	18h
TP	Practical work	3h
AA		6h

Useful info

Name responsible for EU

Lead Instructor
Frédéric Schwander
frederic.schwander@centrale-med.fr