Faculty of Sciences

GEOG2123 Geographical modeling

[30h+30h exercises] 5 credits

Teacher(s):   Eric Deleersnijder, Mark Rounsevell (coord.)
Language: French
Level: Second cycle

Aims

Knowledge:
Enhance the knowledge of modeling techniques using the comprehension of geographical processes. Specificly models based on:
- spatio-temporal analysis using SIG-type technology
- the dynamic approaches using differential equations
- on fractals
Skills:
- Complex analysis of SIG
- Modeling software of dynamic systems
- Mathematical methods in geography

Main themes

Prerequisite:
GEOG 2151 - Geographical information systems
GEOG 2150 - Quantitative geographical analysis methods
Sufficient knowledge in mathematics
Magistral course:
Themes
Introduction
Objectives and course structure
Different types of models
Terminology and definitions, etc.
Student work (theory + PW) : 4
SIG models
Simple spatio-temporal models
Diffusion models (migration and innovation) based on the logistic curb
Spatio-temporal models of neighbouring
Life game
Cellular automates applied to the urbanisation and suburbanisation
Häberstrand "revisited"
Student work (theory + PW) : 12
Transport models
Transport demand
"Variational inequalities"
Student work (theory + TP) : 4
Differential models
Generalities
State variables, parameters
Initial conditions, limit conditions, etc.
Ordinary linear differential models
General solutions
Balance points (stabilitiy, instability, oscillations)
Conservation/dissipation of energy
Exemple (Mururoa Lagoon)
Ordinary non-linear differential models
Balance points (stabilitiy, instability, oscillations)
Conservation/dissipation of energy
Qualitative notions of bifurcation
Qualitative notions on chaos and predicatbility
Examples (logistic curb, Prey/predator, etc.)
Models with temporal and spatial dependance
Differential equations in partial derivatives
Application to the field of interest
Approximation by the "box-model"
Example (Exxon Valdez, Alaska)
Optimizing parameters, validation and analysis of sensibility
Student work (theory + PW) : 30
Analysis of geographical systems
Self-organization of human systems
Dynamics of urban centers
Intra-urban models
Case study: modeling the evolution of the USA (1950-1970)
Student work (theory + PW) : 10
TOTAL 60 (30+30)
Assisted work:
Themes
TD1 SIG models
Spatio-temporal models, diffusion, cellular automates
Student work : 7 hrs
TD2 Differential models

(modelisation and optimization in ModelMaker)
- ordinary
- spatio-temporal
Student work : 18 hrs
TD3 Geographical systems
- urban dynamics
Student work : 5 hrs
Personnal work:
60 hrs of personnal work (report and exam preparation).

Other information (prerequisite, evaluation (assessment methods), course materials recommended readings, ...)

Prerequisites: the course GEOG 2151 "Systèmes d'information géographique".

Other credits in programs

| **GEOG22** | Deuxième licence en sciences géographiques | (5 credits) | Mandatory |