

**EQUATIONS DIFFÉRENTIELLES STOCHASTIQUES ET MÉTHODES NUMÉRIQUES****STOCHASTIC DIFFERENTIAL EQUATIONS AND PROBABILISTIC NUMERICAL METHODS**

Lecturers: Marie-Christophette BLANCHET, Alexandre SAIDI, Céline HARTWEG-

| Lecturers : 16.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 12.0 | Project : 0.0 | Language : AN

Objectives

This course deals with modelisation using time continuous processes. The goal is to present both theoretical and practical aspects on stochastic differential equations. The second part deals with numerical method to simulate stochastic processes. It is more specifically for students of Mathematic, Actuarial and quantitative finance options and Masters. It is required to have followed a course on theory of probability (for example the course in S8 in Ecole Centrale de Lyon)

Keywords : Brownian Motion, Martingales, Ito calculus, Numerical simulations, Monte Carlo Markov chain methods

Programme

1. Mouvement Brownien, intégrale d'Ito processus de diffusion, EDS
2. Méthodes de Monte Carlo, important sampling, réduction de variance
3. Simulation de processus aléatoires (EDS, quantification, autres ?)
4. MCMC, Metropolis Hasting et autres Gibbs

Learning outcomes

- Modelisation with a stochastic differential equation
- Ito calculus
- Approximation of a diffusion. Practical aspects
- Gibbs algorithm or annealing method; Practical aspects

Independent study

Objectifs :

Méthodes : Preparatory works on BE's problems

Core texts

Francis Comets et Thierry Meyre. ., *CALCUL STOCHASTIQUE ET MODÈLES DE DIFFUSIONS.*, Série Mathématiques pour le Master/SMAI, Dunod, 2006
Nicole El Karoui et Emmanuel Gobet. *LES OUTILS STOCHASTIQUES DES MARCHÉS FINANCIERS*, Editions de l'Ecole Polytechnique, 2011
Bernard Bercu et Djilil Chafaï *MODÉLISATION STOCHASTIQUE ET SIMULATION*, Série Mathématiques pour le Master/SMAI, Dunod, 2007

Assessment

Final mark =60% Knowledge + 40% Know-how
Knowledge= 100% final exam
Know-how= 100% continuous assessment