Universidad Técnica Federico Santa María (UTFSM), Valparaíso, Chile

Mini-Course — 13-14 March 2017

Stochastic and Dynamic Optimization. Optimal Energy Storage and Allocation.

Michel De Lara, cermics-École des Ponts ParisTech

March 9, 2017

Eligibility/Pre-requisites.

- Mathematical skills. Computer skills.
- Probability calculus: probability space, probability, random variables, law of a random variable, indicator function, mathematical expectation, independence of random variables, almost-sure convergence and law of large numbers.
- Continuous optimization
- Convexity: convex sets, convex functions, strict and strong convexity (characterization by the Hessian in the smooth case), operations preserving convexity
- Free software Scicoslab to be installed (else, install software Scilab)
- Free software Scicoslab auto-training to be able to do the Monday computer session.

Room.
Campus Casa Central, UTFSM

Link course. `http://cermics.enpc.fr/~delara/TEACHING/AC3E_2017/`

Program

1 / Monday 13 March 2017 (9h45–11h15 and 11h30–13h00), Auditorio B-2.38 (Michel De Lara)

Lecture

Two-stage Stochastic Programming

- The newsvendor problem, without and with backorder; worst case vs. expectation risk criteria
- Two stage stochastic programming (linear case); initial and recourse decision variables; formulation on a tree
- Two stage stochastic programming (strongly convex case); scenario decomposition algorithm
- Two stage stochastic programming (linear case); Progressive Hedging algorithm

2 / Monday 13 March 2017 (14h00–15h30 and 15h45–17h10), Sala P-306 (Pierre Carpentier, Michel De Lara, François Pacaud, Tristan Rigaut)

Computer session

Bring your personal laptop with free software Scicoslab installed.

You are supposed to practice the free software Scicoslab

Sizing of reserves for the balancing on an electric market

3 / Tuesday 14 March 2017 (9h45–11h15 and 11h30–13h00), Sala P-407 (François Pacaud, Tristan Rigaut)

Lecture

Stochastic Dynamic Programming

- Examples of micro-grid management problems: metro station, domestic district, aggregator
- Examples of stock management problems; notion of discrete-time controlled dynamical systems with noise
- Stochastic optimal control problem formulation; resolution by dynamic programming when noise are white
- Curse of dimensionality, complexity

4 / Tuesday 14 March 2017 (14h00–15h30 and 15h45–17h10), Sala P-407 (Pierre Carpentier)

Lecture

Advanced decomposition methods in stochastic optimal control

- Examples and mathematical background
- About decomposition in stochastic optimization
- Dual approximate dynamic programming (DADP)
- Hydro valleys management problem