

MINI-COURSES

Thematic Program on Parameter identification in mathematical models

October 02 to November 30, 2017

IMPA – National Institute of Pure and Applied Mathematics
Rio de Janeiro, Brazil

	Monday Nov/06	Tuesday Nov/07	Wednesday Nov/08	Thursday Nov/09	Friday Nov/10
9:00 - 10:00	Thermal Characterization of Materials at High-Temperatures: Design of Experiment and Multiphysics Inverse Analysis Philippe Le Masson		Kalman and Particle Filters Henrique Fonseca, Cesar Pacheco, Wellington Betencurte, Julio Dutra		
10:00 - 11:00					
11:00 - 12:00					
14:00 - 15:00	Solution of Inverse Problems within the Bayesian Framework of Statistics Ville Kolehmainen		ABC - Approximate Bayesian Computation Diego Estumano		
15:00 - 16:00					

Mini-Course 05: Ville Kolehmainen (Univ. of Eastern Finland, Ville.Kolehmainen@uef.fi)

Title: Solution of Inverse Problems within the Bayesian Framework of Statistics

Period: 06/Nov - 10/Nov (1 week)

Lectures: 6, 7, 8/Nov (from 14:00 to 16:00)

Abstract: The aim of the minicourse is to give an introduction to statistical (Bayesian) inversion. The topics include introduction to Bayesian model for inverse problem, construction of prior and likelihood models, inference over the posterior density using Markov chain Monte Carlo (MCMC) algorithm and treatment of model uncertainties using the approximation error approach.

Mini-Course 06: Philippe Le-Masson (Univ. de Bretagne-Sud, France, lemasson@univ-ubs.fr)

Title: Thermal Characterization of Materials at High-Temperatures: Design of Experiment and Multiphysics Inverse Analysis

Period: 06/Nov - 10/Nov (1 week)

Lectures: 6, 7/Nov (from 9:00 to 12:00)

Abstract: The emphasis of this mini-course will be on how to consider measurement errors for the solution of inverse problems. Examples of measurements will be presented. From these measurements, theoretical modeling of the process will be carried out. In addition, the theoretical hypotheses concerning the intrusive effects of sensors will be discussed. Models integrating the sensors will be proposed. A comparison between the theoretical measurements from the perfect model and those from the sensor model will be analyzed. Applications related to thermocouples and radiative sensors will be presented.

Mini-Course 07: Henrique Fonseca, Cesar Pacheco (Federal Univ. of Rio de Janeiro, Brazil, hmassardf@gmail.com, cesar.pacheco@poli.ufrj.br),
Wellington Betencurte, Julio Dutra (Federal Univ. of Espirito Santo, Brazil, wellingtonufes@gmail.com, juliosdutra@yahoo.com.br)

Title: Kalman and Particle Filters
Period: 06/Nov - 10/Nov (1 week)
Lectures: 8, 9, 10/Nov (from 10:00 to 12:00)

Abstract: In many engineering problems, it is paramount to monitor the system to meet operational objectives, as safety margins and quality parameters. However, direct system observation is a complex task. In this regard, state estimation problems solved through Kalman or Particle Filters are of great interest. The Kalman Filter is a recursive estimator used for the estimation of linear-Gaussian dynamic systems. In this seminar, the method and its recursive equations will be demonstrated. Extensions of the classic approach will be presented, such as the Steady State Kalman Filter, as well as the Extended and Unscented Kalman filter for nonlinear applications. In the Particle Filter method, the posterior density is represented in terms of random samples and associated weights. In the mini-course, background and basic aspects of Particle Filters will be presented, in special the algorithms SIS, SIR and ASIR, with the application to engineering problems.

Mini-Course 08: Diego Estumano (Federal Univ. of Para, Brazil, diegoestumano@hotmail.com)

Title: ABC - Approximate Bayesian Computation
Period: 06/Nov - 10/Nov (1 week)
Lectures: 9, 10/Nov (from 14:00 to 16:00)

Abstract: The so-called Approximate Bayesian Computation (ABC) has been developed for cases where the computation of the likelihood function becomes intractable, for example, when the experimental uncertainties cannot be appropriately modeled in terms of analytical distribution functions. This mini-course will present basic aspects of Approximate Bayesian Computation (ABC), as well as algorithms, including those that allow for simultaneous model selection and parameter estimation.