## INTRODUCTION

This is a course offered to Graduate students interested in current research in solid and fluid mechanics. The course runs June 8-9, 2015, just before the conference ECCOMAS MSF 2015, which is held June 10-12, 2015 (webpage: *http://www.gf.unsa.ba/eccomas-msf-2015/*). Despite a reduced fee, the course students will also be admitted to the conference scientific program, but not to all social events. The course students are, in general, ***not expected*** to make presentation at MSF 2015.

VENUE INFORMATION

The ECCOMAS MSF Conference Course venue is the capital of Bosnia and Herzegovina ***Sarajevo***. The city urban area provides homes to the population of close to half a million over a spread of more than 20 *km* along the river Miljacka. Sarajevo, which is located in the center of the country, has been the major crossroad on migrations path and conquests by Eastern Roman Empire, Slavs, Jews from Spain, Turkish and Austro-Hungarian Empires, each leaving their imprints and contributing to the rich cultural heritage and a number of monumental buildings that still remain in the city.

In more recent time, city of Sarajevo is famous for 1984 Winter Olympic Games, and sadly famous for suffering during long war after the break-up of Yugoslavia. The 'ambiance' is quite different now, and Sarajevo has become a new tourist 'must-see' destination. Month of June is the period just before the massive arrival of tourists, and weather is already sufficiently mild for a very pleasant visit.

Conference course venue/ contact address:
Gradjevinski fakultet (see Figure below)
(with sign: *ECCOMAS-MSF 2015*)
exact address: Patriotske lige 30,
71000 Sarajevo, Bosnia - Herzegovina
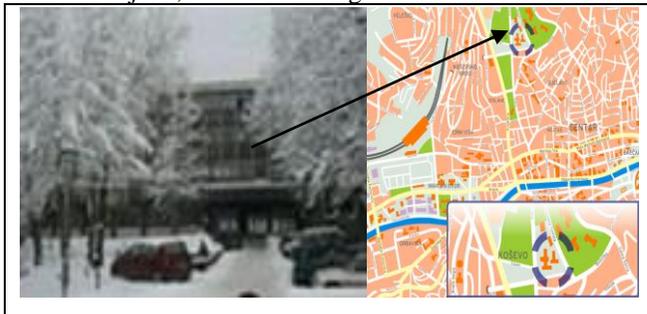
COURSE OBJECTIVES

The main objective of this course is to provide graduate students and researchers, with an extensive review of numerical models for computational solid and fluid mechanics, and pertinent modern developments in model reduction, probability aspects and uncertainty quantification. It presents the current state-of-the-art in finite element, finite volume and discrete element modeling of nonlinear problems in solid and fluid mechanics, and their coupling with thermal fields and interaction. It will illustrate the difficulties (and their solutions), which appear in a number of applications from mechanical, aerospace and civil engineering or material science. All the sources of nonlinear behavior are presented in a systematic manner, related to kinematics, equilibrium, constitutive equations, or boundary and coupling conditions. Special attention is paid to dealing with a class of problems with nonlinear constitutive behavior of materials, large deformations, and rotations in solid and fluid mechanics. In addition, a detailed presentation of modern probability aspects is given, which is of great interest for current research for quantifying the epistemic uncertainties pertinent to the material heterogeneities, and aleatoric uncertainties pertinent to evolution problems.

Our second objective is to provide the participants with a solid basis for using the FEM, FVM or particle based models and software in trying to achieve the optimal design, and/or to carry out a refined analysis of nonlinear behavior of structures or multibody systems in real-life simulations. The course finally provides a basis to account for any pertinent multi-physics and multi-scale effects, which are most likely to provide significant innovations and break-through in a number of industrial applications.

The Course Textbook (cost covered by course fees; each atendee gets English edition of the textbook, unless requesting either French or Bosnian version.).... *more at http://springer.com/978-90-481-2330-8*.

The additional course materials include copy of slides, lectures and unpublished papers, which will be distributed to participants. These lecture pertain to the topics not fully covered by the course textbook, such as theoretical and computational aspects of probability theory, lectures on fluid mechanics.

ECCOMAS MSF 2015 Conference Course

Course Announcement & Call for participants

Short Course at 2ⁿᵈ ECCOMAS MSF 2015
Current Research on Solids & Fluids: Computations, FE Code Coupling, Model Reduction, Probability…

June 8 - 9, 2015

Sarajevo, Bosnia and Herzegovina

co-organized by:
UT-Compiègne/ Sorbonne Universities, France
TU Braunschweig, Germany / GF Sarajevo BiH

REGISTRATION

COURSE MATERIAL

The course material will consist of the graduate textbook written by A. Ibrahimbegovic *Nonlinear Solid Mechanics: Theoretical Formulation and Finite Element Solution Methods*, Springer 2009, a copy of textbook written by N. Limnios 'Semi-Markov Processes and Reliability', a copy of chapter on stochastic FEM written by H.G. Matthies for Encyclopedia and CD-ROM with copies of transparencies from the lectures, survey papers by the lecturers and recent manuscripts. The copy of computer code CO-*FEAP* providing multi-scale parallel-computer implementation of well-known code FEAP, written by Prof. Robert L. Taylor at UC Berkeley, and the Component Template Library (*CTL)* for code-coupling and parallel-computing platform, developed at TU Braunschweig, and the complete manual is available only to course attendees.

COURSE PROFESSORS

Adnan Ibrahimbegovic is Professor Classe Exceptionnelle and Chair for Computational Mechanics at University of Technology Compiègne, an elite engineering school and a founding member of Sorbonne Universités. He has obtained his engineering education in Sarajevo, PhD at the University of California Berkeley, USA and Habilitation at the University Pierre and Marie Curie in Paris, France. He has held professorships and research positions at four different universities (including UC Berkeley, USA; EPFL, Switzerland; ENS-Cachan, France and currently UTC, France). He is the past Chairman of ENS-Cachan Teaching and LMT-Cachan Research Departments and Head of Master Program MaiSE. He has received a number of international distinctions, including IACM Fellow Award, Humboldt Research Award for Germany, Research Award for Slovenia, International Fellow NSERC Award for Canada, 'Claude Levy-Strauss' Chair for Univ. Sao Paulo, Brazil, 'Asgard' Chair for NTNU, Norway, 'Hôte Académique' Award for EPFL, Switzerland. He has produced over 450 publications, including 150 papers in scientific journals and 6 textbooks and monographs.

Hermann G. Matthies has obtained his initial degree from the TU Berlin, Germany; and his doctoral degree in mathematics at MIT, Cambridge, USA in 1978, working on FEM and plasticity. Subsequently he has worked in Research Division of Germanischer Lloyd, Hamburg, Germany, dealing with industrial research and engineering in diverse fields such as wind, offshore, and ice engineering. Since 1995 he joined academia as the Head of the Institute of Scientific Computing at the TU Braunschweig, Germany; and from 1996 to 2006 he was additionally the director of the University Computing Centre. His current research is oriented towards the uncertainty quantification, Bayesian identification and updating, coupled and interaction problems, plasticity and scientific computing. He has received several international distinctions, among them the Fellowship Award of the IACM. Since 2013, he has been appointed Full Member of the "Braunschweigische Wissenschafliche Gesellschaft" (BWG). He has published over 100 papers in scientific journals, as well as over 220 conference publications and topical special issues.

Jean-Michel Ghidaglia is Professor Classe Exceptionnelle at Ecole Normale Supérieure de Cachan, France. He has obtained his engineering diploma at Ecole Polytechnique in 1981, Agregation in Mathematics in 1985 and Doctorate in Applied Mathematics in 1987 from University Paris XI. Subsequently, he has held CNRS research positions, and since 1989, he has been Professor in Applied Mechanics at ENS-Cachan. He has served as the Head of CMLA-Centre of Mathematics and Its Applications, Chairman of Applied Mathematics Department and Head of Master's Program in Applied Mathematics. He has published over 100 papers in scientific journals, and authored or edited several textbooks and monographs in fluid mechanics and applied mathematics.

Nikolaos Limnios, is Professor Classe Exceptionnelle at University of Technology Compiègne (UTC) and Director of the Laboratoty of Applied Mathematics. He has obtained his diploma in 1979 at AUTh Greece, PhD in 1983 and Doctorat d'Etat in 1991 at UTC France. In 1988, he was appointed Maitre de Conférences and in 1993 a Professor at UTC in Laboratory of Applied Mathematics. His research interests include stochastic processes and statistics to different applications domains, such as: reliability, statistical seismology, biology, etc. He has published more than 150 journal papers and several books on theory and applications of stochastic processes,

Pierre Villon is Professor Classe Exceptionnelle at University of Technology Compiègne (UTC) and animator of Labex MS2T Theme-3 on Optimization of System of Systems. He has obtained his diploma in the field of Applied Mathematics in 1980 at INP-Grenoble, his PhD in Optimal Control Theory in 1983 and Habilitation in 1992 from UTC. He has held Professor position at Department of Mechanics at UTC since 1993. His research interests include optimization, inverse problems, model reduction and control theory. He has published close to 100 papers and edited books.

Abdellatif Ouahsine is a Professor and member of administrative board at University of Technology Compiègne (UTC). He has obtained his doctoral degree and Habilitation in Fluid Mechanics from University of Science and Technology Lille. Since 1994, he serves as Head of Laboratory of Computational Hydraulics (LHN), a joint team UTC and CETMEF (French national technical institute of the Ministry of Ecology, Sustainable development and Energy). His current research interest pertain to environmental and computational fluid dynamics (CFD), with special emphasis on fluid-structure interaction. He has published close to 100 papers, and organized several conferences on hydrodynamic modeling, currents and waves in coastal area and river management.

COURSE PROGRAM
1. Variational formulations in nonlinear solid mechanics and inelastic behavior at small strains; 2. Nonlinear mechanics of solids, structures and multibody systems; 3. Solution methods for coupled and interaction problems and software development; 4. Probability aspects and uncertainty quantification; 5. Nonlinear fluid mechanics and multi-phase flows; 6. Fluid-structure interaction and immersed boundary method; 7. Model Reduction by POD-Proper Orthogonal Decomposition and Invariant Preserving Marching on Manifold; 8. Semi-Markov models for reliability and maintenance of systems