



UNIVERSITY  
OF TRENTO - Italy

Department of Civil, Environmental  
and Mechanical Engineering

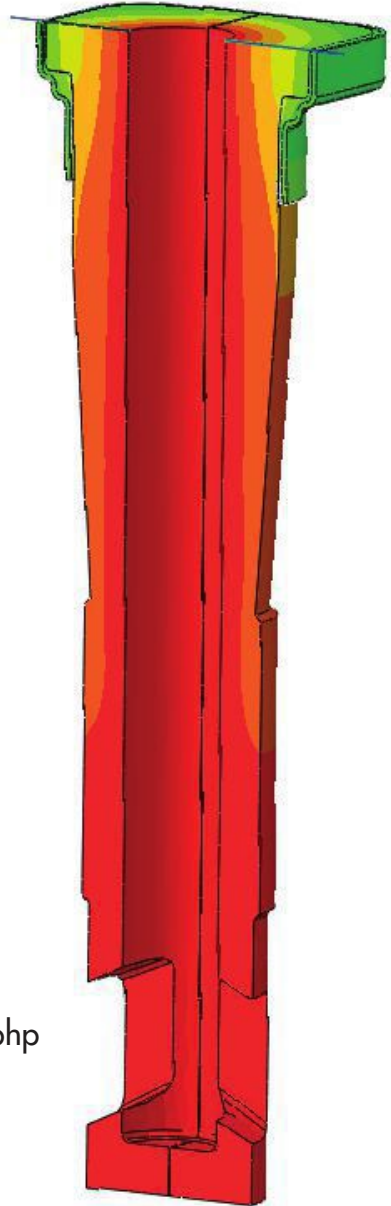
# CERMAT2

## Winter School 2015

February 2-12, 2015

Department of Civil, Environmental  
and Mechanical Engineering  
via Mesiano, 77 - Trento

<http://cermat2.unitn.it/winterschool2015.php>



# General program

## February 2-6

**TC1 "Topics in constitutive modelling of frictional materials: theory and automation of numerical implementation of plasticity at small and large strains" (36hrs)**

This is a network level course providing broad introduction to solid mechanics topics relevant to the research project, including constitutive modelling of frictional and pressure-sensitive materials at small and large strains, theoretical formulations and numerical implementation.

## February 9-11

**TC2 "Introduction to virtual prototyping" (20hrs)**

The programme of the course tackles both enabling technologies in the field of scientific computing (numerical grid generation, finite elements, finite difference and finite volume methods, higher order methods) and a number of important applications (flow processes, design of new materials, subsurface flow, aero-acoustics, agro-food technology, large scale industrial applications) to advance knowledge in a wide range of technical processes and physical phenomena of very high societal interest.

## February 12

**WS1 "Workshop on state-of-the-art and challenges in the modern Ceramic Technology"**

## Venue

The CERMAT2 Winter School will take place at the Department of Civil, Environmental and Mechanical Engineering of the University of Trento (via Mesiano, 77). The Department is located on a beautiful hill, 10 minutes far from Trento city center by taking bus N.5 at the train station.

## Registration

You are not required to pay application or tuition fees. Registrations to the event are open until we reach a limited number of participants. Please send the registration form (available on the CERMAT2 webpage) duly filled in together with your CV to Miss. Irena Jatro ([irena.jatro@unitn.it](mailto:irena.jatro@unitn.it)).

## Teachers Profiles



**Prof. Stanislaw Stupkiewicz** works at the Institute of Fundamental Technological Research (IPPT) of the Polish Academy of Sciences in Warsaw, Poland. He graduated from the Warsaw University of Technology in mechanical engineering and received his PhD (1996) and habilitation (2006) at IPPT. Since 2011 he is full professor. In 2013-2014, he was a visiting professor at the University of Trento at the Solid and Structural Mechanics Group. His research interests include micromechanics of interfaces and interface layers, multiscale modelling of shape memory alloys, constitutive modelling of contact phenomena, contact mechanics, sensitivity analysis, plasticity and computational mechanics.



**Prof. Jože Korelc** graduated from the University of Ljubljana and finished his PhD at the Darmstadt University of Technology. His research examines an interdisciplinary approach to computational mechanics as synthesis of classical numerical methods and symbolic-algebraic systems. He has published numerous articles on finite element technology for solid and contact problems, material modeling, sensitivity analysis, automatic code generation and the use of symbolic methods in engineering. Prof. Korelc is currently Head of the Division of Structures at the Faculty of Civil and Geodetic Engineering, University of Ljubljana, Vice-president of the Scientific Computing Committee of ECCOMAS and a primal developer of the software systems AceGen and AceFEM for on-demand numerical code generation and finite element analysis.



**Prof. Stefano Odorizzi** graduated in Civil Engineering in 1973. He started his activity as researcher in 1976 at the University of Padova, where he holds the course of Solid Mechanics. CEO and co-founder of EnginSoft, a multinational consultancy company engaged in Simulation Based Engineering Science, he actively promotes numerical simulation for research activity, with particular attention to manufacturing processes, metallurgy, multi-disciplinary and multi-objective optimization. His commitment in numerical simulation dissemination is witnessed by his many initiatives as General Manager of EnginSoft, in academic research and advanced training and education.



**Eng. Vito Boriolo** is a Civil Engineer and FEM Project Engineer in Enginsoft, specialized in R&D industrial projects regarding: Oil and gas application (Pressure vessel, heat generators, reactors, Non conventional Creep verification, Nuclear plants, Check valves dynamics, seismic analyses), Turbomachinery applications (Blade creep verification), Automotive applications (Radiator fan dynamics, Vehicles axles structural verification), Civil applications (structural requalification of nuclear power plants).



**Eng. Maurizio Facchinetti** is a Civil Engineer and Project Manager in Enginsoft, specialized in FEM analysis, mainly concerned with R&D industrial projects regarding: Nuclear and Oil&gas applications (High temperature/high pressure pressure vessel, heat generators, reactors, non conventional creep verification, metal gasket flanges), Polymer processing applications (injection molding, extrusion, thermoforming, blow molding) in several industry sectors (Appliances, Automotive, Manufacturing), Rubber processing in the automotive industry, Multiphysics analyses on polymers parts and steel molds.



**Eng. Alessio Trevisan** is a Mechanical Engineer in Enginsoft, specialized in civil structures (seismic assessment), amusement structures (structural assessment of roller coaster and other attractions), offshore structures (structural assessment of jackets, pipes, nodes), large steel structures (stadiums, bridges, equipments), pressure vessels (structural assessment) rail cars (structural assessment).

## Programme - TC1 - February 2-6, 2015

The course will consist of two interlinked parts: constitutive modelling in mechanics of materials and automation of numerical implementation of the constitutive models. The main focus of the first part will be elastoplasticity at small and finite strains. The fundamental concepts of continuum mechanics will be introduced as a basis for a systematic presentation of several constitutive models. The topics covered will include elasticity, elastoplasticity with isotropic and kinematic hardening and coupled thermoplasticity, as well as selected specialized models such as crystal plasticity. In addition to the usual formulation of each model, it will be shown how to formulate the model in a way that the advanced automation tools discussed in the second part of the course can be efficiently used for its numerical implementation. Considering numerical implementation, a general structure of incremental constitutive equations and return mapping algorithm will be introduced. The second part of the course will first address the broad area of advanced software technologies for scientific computing. It will be demonstrated that an efficient automation of a general formulation of plasticity models can be achieved using the automatic differentiation technique combined with the symbolic problem description, automatic code generation and code optimization. The main objective of the course is to provide theoretical background as well as practical practical training for automatic generation of nonlinear finite element codes using Mathematica based code generation system AceGen ([www.fgg.uni-lj.si/symech/](http://www.fgg.uni-lj.si/symech/)). Participants will get insight into the mathematical formulation of a problem, its symbolic description with symbolic code generator AceGen, methods for verification of the model and the generated code and a final implementation in the finite element environment AceFEM and ABAQUS. The advantages of using automatic differentiation technique and symbolic description of plasticity models will be demonstrated on several examples including: hyperelasticity, finite-strain plasticity, coupled thermo-mechanical problems and multi-scale analysis. The lectures will be given in computer laboratory. Students will be encouraged to try to use symbolic approach on their specific field of research. All the participant will get students AceGen/AceFEM license and lecture notes.

**Classroom** - equipped with blackboard and computer projector.

**Computer laboratory** - The lectures will be given in a computer laboratory. All the participants will get students AceGen/AceFEM licence. Students that will use their own notebook must have symbolic system Mathematica version 9.0 or 10.0 preinstalled.

	Monday, 2/2	Tuesday, 3/2	Wednesday, 4/2	Thursday, 5/2	Friday, 6/2
09:00-12:30	Classroom (S.S. and J.K.)	Computer lab (J.K.)	Classroom (S.S.)	Classroom (S.S.)	Classroom (S.S. and J.K.)
14:00-17:30	Classroom (J.K.)	Classroom (S.S.)	Computer lab (J.K.)	Computer lab (J.K.)	14:00-18:30 Computer lab (J.K. and S.S.)

## Programme - TC2 - February 9-11, 2015

	Monday, 9/2	Tuesday, 10/2	Wednesday, 11/2
08:30-12:30	The FEM for structural analysis (S.O.)	Applications (V.B.)	Applications (A.T.)
14:00-18:00	The FEM for structural analysis (S.O.)	Applications (M.F.)	

## Programme - WS1 - Thursday, February 12, 2015

### Morning session, general lectures

- 8:40-9:40 *Chemically-bonded ceramics and composites: materials, processes and applications*  
Valentina Medri, Alida Bellosi, ISTECCNR, Faenza
- 9:40-10:40 *State of the art and future trends in the industrial production of ceramic tiles*  
Alessandro Cocquio, SACMI Imola SC, Imola
- 10:40-11:10 Coffee break
- 11:10-12:40 *Technology of tetragonal zirconia polycrystals and related ceramics*  
W. Pyda, AGH University of Science and Technology
- 12:40-14:00 Buffet lunch

### Afternoon sessions, PhD students presentations

- 14:00-15:00 ESR1 M.S. Swan  
ESR2 A. Kessaci  
ESR3 G. Vitucci
- 15:00-16:00 ESR4 A. Vinakurava  
ESR5 N. Gorbushin  
ESR6 D. Tallarico
- 16:00-17:00 ESR7 M. Biglar  
ESR8 S. Pandey  
ER1 A. Borhan

## Contacts

**Prof. Andrea Piccolroaz**

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## Supporters

