Oreste S. Bursi

Oreste S. Bursi graduated in Mechanical Engineering at the University of Padua in 1984, and achieved his PhD. in Mechanical Engineering at the University of Bristol. He is Full Professor of Structural Dynamics and Control at the University of Trento. The research activity is mainly devoted to the pseudo-dynamic test method, non-linear dynamics, control and structural identification.
http://r.unitn.it/en/dicam/nhmsdc
http://me.unitn.it/oreste-bursi/

Nicola Tondini

Nicola Tondini received his PhD in Structural Engineering at the University of Trento in 2009. He is currently Assistant Professor at the Department of Civil, Environmental and Mechanical Engineering at the University of Trento. His research interests mainly involve the behaviour of structures subjected to fire, both experimentally and numerically, with emphasis on the development of advanced computations methods.

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University of Trento

Doctoral School in Civil, Environmental and Mechanical Engineering

UNIVERSITÀ DEGLI STUDI DI TRENTO

Nonlinear thermomechanical and coupled dynamic problems in structural applications

Course offered by **Oreste S. Bursi**, University of Trento and **Nicola Tondini**, University of Trento.
November 26-27, 2015.

Department of Civil, Env. and Mechanical Eng. University of Trento.

Course objective

The scope of the course is to provide knowledge of nonlinear analysis of dynamic as well as of thermo-mechanical systems solved by means of the Finite Element Method. With regard to dynamic problems, the main properties of numerical integrators for the determination of the transient dynamic non-linear response of monolithic structural systems, as well as of heterogeneous subsystems, decomposed by computational or physical considerations is presented. Thus, ad hoc computational methods are presented in a common framework along with a few applications. As regards thermo-mechanical problems, basic theoretical formulation of thermoelasticity will be highlighted with emphasis to the FE method applied to heat conduction problems. Nonlinear FE thermomechanical examples in the context of structural engineering applications will be presented.

Who should attend

Graduate students in engineering interested in nonlinear structural dynamics and in thermo-mechanical problems, and researchers, in modern mechanical/structural engineering.

Course outline

Form of equations of Structural Dynamics and Solution Techniques. Euler-Lagrange form. Hamilton form. Corrections and compensation techniques for non-linear problems.

Monolithic and partitioned time integration schemes for dynamic systems. L-stable methods for monolithic systems. L-stable methods for heterogeneous coupled systems. Partitioned methods based on the FETI approach. The PM-alpha method. Representative model problems and case studies.

Analysis and properties of time integration algorithms in the non-linear regime. Analysis of time integration algorithms. Accuracy, Absolute Stability and the phenomenon of stiffness. Dissipation and dispersion. Error propagation.

Fundamentals of thermoelasticity and FE method applied to heat conduction problems. Basic laws of thermoelasticity and of thermodynamics of elastic continuum. Basic concepts of the FE method. Formulation of heat conduction FE problems.

Nonlinear thermomechanical problems in structural applications. Mechanical and geometric nonlinearities in thermomechanical problems. Thermomechanical finite beam elements with corotational formulation. Case studies of structures subjected to fire analysed by means of FE method.

Suggested readings.

- *Bursi O.S., (2008), Computational Techniques for Simulation of Monolithic and Heterogeneous Structural Dynamic Systems in Modern Testing Techniques for Structural Systems -Dynamics and Control*, O.S. Bursi and D.J. Wagg ed., CISM-Springer Wien NewYork.
- Hughes, T.J.R., (2000) The Finite Element Method: Linear Static and Dynamic Finite Element Analysis -Dover Civil and Mechanical Engineering-.
- R.B. Hetnarski; M. Reza Eslami Thermal Stresses – Advanced Theory and Applications, springer, 2008.
- O.C. Zienkiewicz, R.L. Taylor and J.Z. Zhu, The Finite Element Method – Its Basis & Fundamentals, 6th Edition, Elsevier, 2008.
- *Franssen J.-M. (2005) SAFIR. A Thermal/Structural Program Modelling Structures under Fire, , Engineering Journal, A.I.S.C., Vol 42, No. 3, 143-158*

Course schedule

Thursday, November 26, 2015
H1 Room
14.00-18.30
Friday, November 27, 2015
H1 Room
9.30-13.30
14.30-18.30

Information

The course is free of charge.
For further information, contact

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