Università degli Studi di Pavia

Dipartimento di Meccanica Strutturale

in collaboration with

Centro di Simulazione Numerica Avanzata – CeSNA

Istituto Universitario di Studi Superiori

SEMINAR

Automation of Computational Modeling

The use of advanced software technologies is playing a central role in the process that leads to the automation of computational modeling. The problem of automation of computational methods has been explored by researches from the fields of mathematics, computer science and computational mechanics, resulting in a variety of approaches (e.g. a hybrid object-oriented approach and a hybrid symbolic-numeric approach) and available software tools (e.g. computer algebra systems, automatic differentiation tools, problem solving environments and numerical libraries). However, the true advantages of automation become apparent only if the description of the problem, the notation and the mathematical apparatus used are changed as well. It will be demonstrated that this can be achieved using the automatic differentiation technique combined with the symbolic problem description, automatic code generation and code optimization. Thus, the basis for the proposed automation is an automatic differentiation based form of basic equations used to describe the problem. The introduced notation does not only simplify the derivation of the corresponding equations, but also reflects much more closely the actual algorithmic implementation. The advantages of using automatic differentiation technique and symbolic description of computational models will be demonstrated on several examples including: general formulation of finite elements for direct and sensitivity analysis of path-dependent problems; formulation of finite elements for finite strain plasticity problems and extended system models for direct determination of stability points. All the examples were made using the Mathematica based automatic code generation system AceGen (www.fgg.uni-lj.si/symech/).

Prof. Joze Korelc
University of Ljubljana
Faculty of Civil and Geodetic Engineering

Wednesday 23 November, 11.00
MS1 Conference Room,
Department of Structural Mechanics,
Via Ferrata,1 – Pavia