

**06-5 IUTAM Symposium on Discretization Methods for Evolving Discontinuities**

Lyon, France, September 04 - September 07, 2006

**a) Scientific Committee**

D.E. Beskos (Greece), R.de Borst (Co-chair, The Netherlands), A. Combescure (Chair, France), T. Belytschko (Co-chair, USA), C. Farhat (USA), D. Gross (Germany), B. Karihaloo (UK), N. Olhoff (Denmark, IUTAM representative), U. Perego (Italy)

**b) Short summary of scientific progress achieved**

The seminar has been organised to permit wide interactions between the participants. The number of invited talks has been limited to 25 and each speaker had 30 minutes for his presentation plus 10 minutes for discussion. In keeping with IUTAM policy there were no parallel sessions. Each invited speaker was allowed to take up to two PhD students free of charge. They were all invited to present a poster and to participate in the discussions and other activities. The time schedule was enforced weakly in order to maximize interaction between the participants.

The seminar was devoted to theoretical issues and numerical simulations of moving discontinuities. The presentations were organised according to a matrix with theories on one axis (fracture, damage, interfaces, dislocations) on one axis, and numerical methodologies on the other axis (PUM/XFEM methods, embedded FEM methods, discontinuous Galerkin methods, meshfree methods) on the other axis. It has been tried to have at least one presentation in each entry of this matrix, thus leading to an optimal cross-fertilization.

The symposium also permitted to compare static and dynamic problems and applications coming from different communities: civil engineering, mechanical engineering, forming processes, and biomechanics. Some of the participants came from the applied mathematics community, and they have given an interesting input in the discussions.

**c) Countries represented and number of participants**

The total number of participants was 38 from 10 different countries. The division of the delegates from the different countries was as follows: USA 6, France 6, UK 4, Germany 3, Netherlands 3, Italy 2, Belgium 1, Greece 1, Spain 1 and Sweden 1.

10 PhD students from France, Germany, Spain and the Netherlands participated in the symposium.

**d) Publication of Proceedings of the Symposium**

All invited speakers except for one have submitted a full paper of 14 to 20 pages. All papers have been reviewed and have been handed over to Kluwer on 10 March, 2007.

## e) Financial supports

Apart from the contractual support by Kluwer and the conference facilities made available by INSA Lyon, the following financial support was received:

- Reception on Tuesday evening offered by INSA Lyon
- Région Rhone-Alpes has supported the costs of the proceedings
- CNRS has given a grant of 1500 Euros to support the symposium
- AUM (Association Universitaire de Mécanique) has provided a support of 1500 Euros

## f) Scientific program

### Monday, 4 September

E.Kuhl “*On the application of discontinuous Galerkin methods to interface problems*”

R. Haber “*Modelling evolving discontinuities with spacetime discontinuous Galerkin methods*”

T. Belytschko “*On finite element and meshfree methods for crack propagation*”

B. Karihaloo “*Accurate simulation of frictionless and frictional cohesive crack growth in quasi-brittle materials using XFEM*”

W.K. Liu “*Multiresolution mechanics of materials*”

E.H. van Brummelen “*Conservation at fluid-structure interfaces under incompatibility*”

F. Hild “*Measurement and identification techniques for evolving discontinuities*”

### Tuesday, 5 September

F. Chinesta “*The natural element method for simulating evolving discontinuities*”

H. Askes “*Meshless discretisation of nonlocal damage theories*”

A. Gravouil “*Application of X-FEM to real cracks and elastic-plastic fatigue crack growth*”

R. de Borst “*The cohesive-segments method for the simulation of dynamic fracture*”

G. Holzapfel “*Modelling of evolving discontinuities in biological tissues*”

J. Réthoré “*A discrete model for the propagation of discontinuities in a fluid-saturated medium*”

G. Meschke “*X-FEM-based analyses of cementitious materials: hygro-mechanical formulation and energy based modelling of crack propagation*” *propagation of discontinuities in a fluid-saturated medium*”

### Wednesday, 6 September

S. Bordas “*A combined extended finite element and level set method for biofilm growth*”

G. Ventura “*Single domain quadrature techniques for discontinuous and non-linear enrichments in local Partition-of-Unity F.E.M.*”

G. Wells “*A finite element formulation for modelling phase separation problems*”

Y. Renard “*High order finite element method for cracked domains*”

F. Armero “*Recent developments in the formulation of finite elements with embedded discontinuities for the modelling of failure in solids*”

A. Pandolfi “*Variational cohesive fracture models and three-dimensional crack tracking*”

J. Oliver “*Evolving material discontinuities: numerical modelling in the context of the strong discontinuity approach*”

D. Beskos “*Numerical determination of crack stress and deformation fields in gradient elastic solids*”

B. Bourdin “*Numerical implementation of a variational formulation for brittle fracture*”

## **Postersession**

### **Thursday, 7 September**

N. Moes “*Recent progress in the development of the eXtended Finite Element Method: mixed problems, explicit dynamics and 3D fracture mechanics*”

A. Combescure “*Recent advances in dynamic crack propagation simulations using TX-FEM methods*”

**Report composed by Alain Combescure and René de Borst**