

## **COMPLAS 2019**

### **Invited Session 33 on**

#### **Theory of fracture, crack propagation criteria, and crack tracking algorithms**

Organized by

**Anna Pandolfi**, Politecnico di Milano, Italy

**Michael Ortiz**, California Institute of Technology, USA and Bonn University, Germany

In brittle or quasi-brittle materials under complex loading condition the nucleation and propagation of cracks is still under an extensive investigation. The key issue is given by the difficulty to predict the crack path, in particular when multiple loads are acting and the crack is expected to manifest unstable behaviors. Theory of fracture tries to describe mathematically the complex physics of the process, characterized by the changes of topology due to the formation of new surfaces with unknown location and orientation. Theoretical formulations can be taken as the basis of numerical algorithms where the accuracy of the solution can be monitored or controlled.

Propagation of cracks satisfy physical criteria expressing the local attainment of the ultimate strength of the material. Recent formulations based on energetic reasoning opened an interesting avenue for the definition of new algorithms. Popular numerical techniques are based on finite element discretization, where fracture is described explicitly by reproducing newly created surfaces. Surfaces are inserted between or across solid elements. Phase-field approaches are appealing for the easiness of the implementation. Boundary element techniques have also provided satisfactory results. Recent approaches disregard the presence of a classical mesh, avoiding the complication of disconnecting volume elements. Advanced numerical models of fracture are based on multi-scale descriptions and in some cases integrate different numerical techniques.

In this invited session of Complas we would like to bring together researchers and scientist that are working on new theoretical approaches and advanced numerical algorithms to explore possible future developments of numerical methods for crack nucleation and crack tracking. New algorithms and new approaches are welcome, as well as improvement and applications of well settled formulations.