

Centro di Simulazione Numerica Avanzata – CeSNA

Istituto Universitario di Studi Superiori

In collaborazione con
Università degli Studi di Pavia
Dipartimento di Meccanica Strutturale

Extended finite elements with application to dynamic crack propagation

The modeling of discontinuities in numerical methods such as finite elements is a difficult task. Indeed standard approaches require an explicit representation of the considered discontinuities (e.g. cracks, etc...) by the finite element mesh. This can become problematic for large 3D applications and when the discontinuity is moving. The extended finite element method, introduced ten years ago, allows us to have an implicit representation of those discontinuities. By adding appropriate enrichment functions associated to new degrees of freedom it is now possible to represent them independently of the finite element mesh. Curved free boundaries, solid-fluid interfaces, solid-solid interfaces are some of the examples to which X-FEM was applied but the modeling of cracks is the topic that has drawn most of the attention of researchers. In our institute, we have developed numerical methods based on the X-FEM for 2D and 3D fatigue crack growth with non-linearities (plasticity, contact, friction) and fast dynamic propagation. After reviewing the basics of the X-FEM, its limitations and some of the improvements that were proposed, I will present our main results for the simulation of 2D dynamic brittle crack growth. We have developed energy conserving dynamic schemes, both implicit and explicit, as well as appropriate methods for the appropriate fracture mechanics parameters evaluation. This provides a robust tool to simulate and predict accurately fast dynamic crack propagation experiment in mixed mode that are also done in the lab.

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Venerdì 18 Dicembre, Aula MS1
Seminar tentative schedule: 10.00 – 12.30
Dipartimento di Meccanica Strutturale
Via Ferrata,1 – Pavia