Geophysical Research Abstracts,
Vol. 10, EGU2008-A-06163, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-06163
EGU General Assembly 2008

Dynamic rupture modeling on unstructured meshes using discontinuous Galerkin methods

J. de la Puente (1), JP. Ampuero (2) and M. Käser (1)

(1) Department of Earth and Environmental Sciences, LMU Munich, Germany, (2) Institute of Geophysics, ETH Zürich, Switzerland

The emergence of dynamic source modeling as a key component of physics-based strong motion prediction, for seismic hazard assessment and for earthquake source inversion, requires the ability to model complicated, realistic geometries with high computational efficiency (low CPU time at a given accuracy).

We introduce the application of the ADER-DG method to simulate earthquake rupture dynamics. The ADER-DG method is based upon a discontinuous Galerkin formulation and uses triangles or tetrahedra as computational cells. As a consequence, very complex surfaces and volumes can be easily meshed using external automated tools. The ADER-DG method has been successfully applied to the elastodynamics of wave propagation and has the advantage of being high-order accurate in space and time, simultaneously.

Discontinuous Galerkin methods are well suited for the solution of problems of dynamic rupture as the variables (stresses and velocities) are naturally discontinuous at the interface between elements. One must just require that the fault is honoured by the computational mesh. Fault geometries of arbitrary complexity can be modeled due to the high flexibility of an unstructured mesh, which solves a major bottleneck of other high order methods like the Spectral Element Method. Additionally, element refinement and coarsening are easily controlled in the meshing process to better resolve the near-fault area of the model.

The fundamental properties of the method will be shown, as well as a series of validating exercises with reference solutions and a comparison with the well-established

Spectral Element Method, in order to test the accuracy of our formulation. Examples will be presented to illustrate the main potentials of the new method.