Discontinuous Galerkin method in modeling damage dynamics

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We develop here a discontinuous Galerkin (DG) method to investigate the wave propagation in heterogenous brittle materials, modeled by a linear elastic body with a family of (small scale) cracks in uni-lateral frictional contact. In the classical finite element technique an inner boundary condition requires a geometrical treatment, hence the computational effort became very important for a large number of micro-cracks. In contrast, in the DG method the inner boundary conditions are modeled by the flux choice without an additional computational cost, even for many micro-cracks. Due the non-linear conditions (non penetration, friction, etc) on the inner boundaries (micro-cracks) the problem is nonlinear. That is why we have used a numerical upscaling homogenization technique to find the effective properties of the damaged material. We analyze the wave propagation (speed, amplitude and wavelength) of micro-cracked materials in simple or more complicated configurations