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# DYNAMIC DAMAGE LAW FOR ROCK BLASTING

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This paper proposes a new continuum damage model accounting for inertial effects [1] to analyse the fracture behaviour of rock in tension due to blasting. The two-scale damage model is fully deduced from small-scale descriptions of dynamic micro-crack propagation under tensile loading (mode I) [2]. The micro-crack distribution is assumed locally periodic. The size of a periodicity cell is the distance between the centres of neighbour micro-cracks. Each crack is assumed to be parallel and straight. The damage variable is the ratio between the micro-crack length and the period size. Asymptotic development allows deducing the homogenised stiffness of the material.

The macroscopic evolution law for damage is deduced from an appropriate micro-mechanical energy analysis [3-6] combined with asymptotic homogenization. We obtained a dynamic damage law for which the quasi-static damage equation represents the limit case for low rate of deformation.

Numerical simulations are presented in order to illustrate the ability of the model to describe known behaviours like size dependency of the structural response, strain-rate sensitivity and brittle-ductile transition. The efficiency of the model is demonstrated by comparing the numerical results with experimental data concerning the strain-rate sensitivity of the tensile strength, obtained from spalling tests with isentropic pressure wave generator [7]

The global macroscopic response predicted by the model is obtained by implementation of the dynamic damage law in the finite elements code LAGAMINE [8]. The damage pattern around the blasthole has been simulated. Numerical simulations illustrate the ability of the model to reproduce the radial cracks zone due to rock blasting. The influence of microstructural size on damage distribution around the blasthole is determined. The link between the borehole specific charge and radial cracks zone is studied.

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