*Abstract*

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## On dynamic crack growth in discontinuous materials

In this thesis work numerical procedures are developed for modeling dynamic fracture of discontinuous materials, primarily materials composed of a load-bearing network. The models are based on the Newtonian equations of motion, and does not require neither stiffness matrices nor remeshing as cracks form and grow. They are applied to a variety of cases and some general conclusions are drawn. The work also includes an experimental study of dynamic crack growth in solid foam. The aims are to deepen the understanding of dynamic fracture by answering some relevant questions, e.g. What are the major sources of dissipation of potential energy in dynamic fracture? What are the major differences between the dynamic fracture in discontinuous network materials as compared to continuous materials? Is there any situation when it would be possible to utilize a homogenization scheme to model network materials as continuous? The numerical models are compared with experimental results to validate their ability to capture the relevant behavior, with good results. The only two plausible dissipation mechanisms are energy spent creating new sur- faces, and stress waves, where the first dominates the behavior of slow cracks and the later dominates fast cracks. In the numerical experiments highly connected ran- dom fiber networks, i.e. structures with short distance between connections, behaves phenomenologically like a continuous material whilst with fewer connections the behavior deviates from it. This leads to the conclusion that random fiber networks with a high connectivity may be treated as a continuum, with appropriately scaled material parameters. Another type of network structures is the ordered networks, such as honeycombs and semi-ordered such as foams which can be viewed as e.g. perturbed honeycomb grids. The numerical results indicate that the fracture behavior is different for regular honeycombs versus perturbed honeycombs, and the behavior of the perturbed honeycomb corresponds well with experimental results of PVC foam.