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SHOCKS THROUGH INHOMOGENEOUS MATERIALS WITH SPH

Iason Zisis[1]*, Bas J. van der Linden[2] and Barry Koren[3]

[1] Eindhoven University of Technology, Den Dolech 4, 5612AZ, The Netherlands, i.zisis@tue.nl and http://www.win.tue.nl/casa/aboutus/tempstaff/161.html
[2] Laboratory for Industrial Mathematics Eindhoven, Esp 405, 5633AJ, The Netherlands, bas.linden@limebv.nl and http://www.limebv.nl
[3] Eindhoven University of Technology, Den Dolech 4, 5612AZ, The Netherlands, b.koren@tue.nl and http://www.win.tue.nl/casa/aboutus/permstaff/174.html

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Shocks through solid materials appear during impacts of small-sized space debris or micrometeoroids into spacecraft shields [1]. These *hypervelocity impact* events are characterized by impact velocities higher than the speed of sound of most metals. Laminated structures are often used as shielding materials for satellites and impact-induced shocks interact with the interface of two materials [2,13].

Smooth Particle Hydrodynamics (SPH) numerical method is typically used for the simulation of hypervelocity impacts [3–5] and has given insight into shock loading of homogeneous materials. Nevertheless, shock wave propagation through laminated structures is customarily treated with homogenization of the structure [3,4,7,10]. Homogenization neglects wave transmission-reflection effects on the interface of different materials. In order to resolve the interaction of shocks with the interface, multiphase SPH algorithms may be used. Based on a variational framework [6,8,9] different SPH multiphase algorithms were developed for the fully compressible regime and numerical tests revealed the most adequate for shocks through inhomogeneous materials [11,12].

Using the selected algorithm, the current study examines characteristic cases of shock propagation into inhomogeneous materials in a two dimensional setup. Firstly, an impact-induced shock into a laminated structure is considered, with its front being initially horizontal to the interface of the materials. Secondly, wave propagation of an impact-induced shock vertical to the interface of a laminated structure is studied. Finally, the impact into a laminated structure, which consists of an intermediate layer made up from a matrix material and spheres of fillamnent material is presented.

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