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Mesoscale Numerical Investigation of Damage Processes in Geologic Materials under Meteorite Impact

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Planar shock waves in simplified 2D mesoscale sandstone models have been simulated in order to derive equation of state properties for large scale impact simulations. The prediction of crater shapes, ejecting fragments, vapor plume expansion, interaction with atmosphere, requires material models that incorporate failure and damage. For this purpose, detailed mesoscale structures of sandstone are generated based on computer-tomography data and implemented in a specialized Finite Element code. As sandstone essentially consists of cemented quartz crystals, material models for quartz, inter-granular contact and failure are required. By simulating quasi-static, dynamic and shock loading, averaged material response can be obtained. This homogenized data is then used to derive material models appropriate for macroscale meteorite impact simulations. Once this procedure has successfully been applied to sandstone, it will be used for other geologic materials.

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