A comparison of two and three-dimensional meso-scale simulations as applied to the compaction of porous heterogeneous materials

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Abstract

Many scientific areas of endeavor require a fundamental understanding of the response of heterogeneous granular materials when subjected to high-pressure, high-strain rate loading, such as ballistic penetration of sand. This presentation will focus on work that seeks a better understanding of these events by performing simulations where each particle within a domain is resolved. This is a departure from bulk simulations in which the heterogeneous material is represented by a spatially averaged analog material. By including a sufficient number of particles we attempt to predict the bulk response by modeling and averaging the underlying particle response, while retaining the heterogeneous nature of the material. In so doing, we resolve the behavior from grain to bulk; this approach is termed middle or meso-scale simulated material behavior. The results from these simulations are compared to experiments where applicable. The methodologies, and results are presented along with a parametric view of the subscale models, in two and three space dimensions.

Biography

Dr. Borg has been at Marquette University, Dept of Mechanical Engineering, since 2002. Before coming to Marquette, he was a Lead Scientist for the Naval Surface Warfare Center in Dahlgren Virginia from 1997 to 2002, an NSF International Postdoctoral Fellowship at Cambridge University from 1996 to 1997 and received his PhD in Mechanical Engineering from University of Massachusetts, Amherst in 1996. His primary area of research involves shock physics phenomenology focused on large-scale meso-scale simulations, deriving constitutive relations and equations of state suitable for energetic and granular materials undergoing shock compression events.