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Assessing continuum postulates for tumbling mills

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Abstract content
   (Max 300 words)
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Dense granular flow is qualitatively similar to fluid flow. Given the high computational cost of simulating discrete problems with large numbers of particles, this qualitative similarity is often exploited and the problem is modelled as a viscous fluid. A crucial aspect of this process is the parametrisation of the constitutive response of the material. This can be argued by considering the micromechanical properties. The purpose of this work is to investigate the validity of the continuum fluid approximation of granular systems in the context of tumbling mills.

At the continuum level, the viscosity of a fluid relates the velocity gradient to the shear stress. In contrast to fluids however, no single interpretation of viscosity for granular systems using micromechanical arguments exists. Recent work has shown that under certain conditions a continuum approximation may be inapplicable. In [Rycroft et al., JMPS, 57 (2009) 828-839] the continuum postulate was assessed by analysing large-scale discrete element method simulations of dense, confined granular flow. This was done by viewing the macroscopic flow as an ensemble of Eulerian and Lagrangian representative volumetric elements. The material evolution of these elements was then tracked during the simulation. This work will use the methods described by Rycroft et al. to investigate the material evolution in simulations of tumbling mills.

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PhD

Main supervisor (name and email)
and his / her institution

Dr Indresan Govender, UCT, indresan.govender@uct.ac.za

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No

Primary author: Mr POVALL, Timothy (University of Cape Town)

Co-authors: Dr MCBRIDE, Andrew (University of Cape Town); Dr GOVENDER, Indresan (University of Cape Town)

Presenter: Mr POVALL, Timothy (University of Cape Town)

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