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**Nicholas Metropolis Award for Outstanding Doctoral Thesis Work in Computational Physics Talk: Elasto-Plastic Modeling of Steady Granular Flow**

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Despite their ubiquity in day-to-day life, granular materials have surprisingly complicated flow properties. This talk constructs and tests a general continuum model for dense granular matter, which predicts the stress and velocity profiles in well-developed flows. Recent models for granular elasticity (Jiang and Liu 2003) and rate-sensitive plastic flow (Jop et al. 2006) are reformulated and combined into one universal elasto-plastic law, capable of determining flowing regions and stagnant zones simultaneously in any arbitrary 3D flow geometry. To merge the responses, we enforce a Kroner-Lee decomposition and constrain the constitutive laws to obey necessary physical principles. The model is numerically implemented as a VUMAT in ABAQUS/Explicit, and results are directly compared to experiments and discrete particle simulations in several inhomogeneous flow geometries. We conclude with an evaluation of the overall breadth of the model, and provide preliminary arguments for how to enhance the description using non-local quantities.