Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Effect of Inertia and Damping on Avalanche Distributions in Sheared Amorphous Solids[1] K. MICHAEL SALERNO, Johns Hopkins University, CRAIG MALONEY, Carnegie Mellon University, MARK O. ROBBINS, Johns Hopkins University — Avalanches occur in a variety of contexts from magnets to granular materials. Molecular dynamics simulations of a sheared binary Lennard-Jones glass are used to explore the effect of inertia and damping on avalanche distributions. We find that the energy dissipation rate is one of the key factors in determining the size of an individual avalanche as well as the distribution of avalanche energies. There are three distinct regimes: an overdamped regime where the distribution has an exponential cutoff that varies with dissipation rate, a critical regime where avalanches follow power-law statistics and large events are limited by simulation size, and a run-away regime where inertia leads to a peak at large energies. The same regimes are found for Langevin type viscous damping and Galilean-invariant Kelvin damping. While inertia determines how an avalanche evolves, some properties of the avalanche are predetermined. Weakening of the average shear modulus prior to an avalanche is a good indicator that a large, system-spanning event may occur.

[1]This material is based upon work supported by NSF Grant DMR 108474.

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Date submitted: 19 Nov 2010 Electronic form version 1.4