Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Stability Theory for Interfacial Patterns in Magnetic Pulse Welding ALI NASSIRI, GREGORY CHINI, BRAD KINSEY, University of New Hampshire, UNH TEAM — Magnetic Pulse Welding (MPW) is a solid state, high strain-rate joining process in which a weld of dissimilar or similar materials can be created via high-speed oblique impact of two workpieces. Experiments routinely show the emergence of a distinctive wavy pattern, with a well defined amplitude and wavelength of approximately 20 and 70 micrometers, respectively, at the interface between the two welded materials. Although the origin of the wavy pattern has been the subject of much investigation, a unique fundamental physical theory for this phenomenon is as yet not widely accepted. Some researchers have proposed that the interfacial waves are formed in a process akin to Kelvin-Helmholtz instability, with relative shear movement of the flyer and base plates providing the energy source. Here, we employ a linear stability analysis to investigate whether the wavy pattern could be the signature of a shear-driven high strain-rate instability of an elastic-plastic solid material. Preliminary results confirm that an instability giving rise to a wavy interfacial pattern is possible.

Ali Nassiri
University of New Hampshire

Date submitted: 01 Aug 2013 Electronic form version 1.4