Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Simulations of Non-spherical Bubble Collapse Dynamics in Viscous and Viscoelastic Media Near a Compliant Object[1] MAURO RODRIGUEZ, ERIC JOHNSEN, University of Michigan, Ann Arbor — Understanding the dynamics of cavitation bubbles and the shock waves emitted by their collapse in and near viscoelastic media is important for various naval and medical applications, particularly in the context of cavitation damage. Two examples are histotripsy, which utilizes this phenomenon for the ablation of pathogenic tissue, and erosion to elastomeric coatings on propellers. Although not fully understood, the damage mechanism combines the effect of the incoming pulses and cavitation produced by the high tension. Additionally, the influence of the shock on the material and the response of the material to the shock are not well known. A novel numerical approach for simulating shock and acoustic wave propagation in Zener-like viscoelastic media is proposed. This Eulerian method is based on a high-order accurate weighted essentially non-oscillatory scheme for shock capturing and introduces evolution equations for the components of the shear stress tensor. Validation studies between high-fidelity two-dimensional simulations of the bubble collapse dynamics for various experimental configurations (i.e. the viscous or viscoelastic material surrounding the bubble and the nearby compliant object are varied) will be presented.

[1]This work is supported by ONR grant N00014-12-1-0751.

Mauro Rodriguez
University of Michigan, Ann Arbor

Date submitted: 31 Jul 2015 Electronic form version 1.4