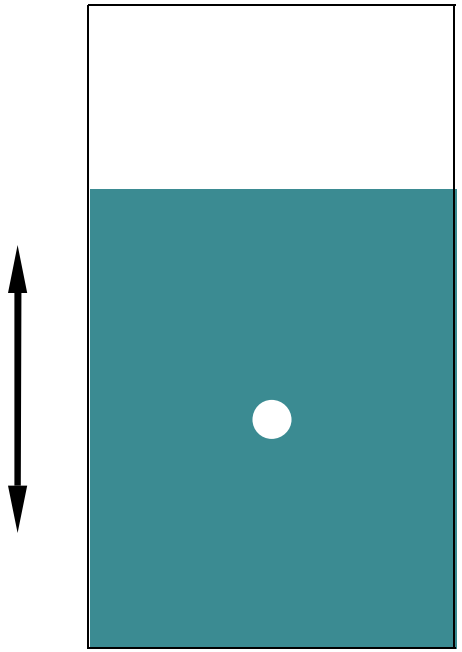
Simulations of Bubble Motion in an Oscillating Liquid

SAND2010-8069P



$g = g_0 + x_0 \omega^2 \cos \omega t$

$g_0 \sim 0$

Andrew M. Kraynik,
Louis Romero, John R. Torczynski,

Sandia National Laboratories
Albuquerque, NM

Outline

Finite element analysis

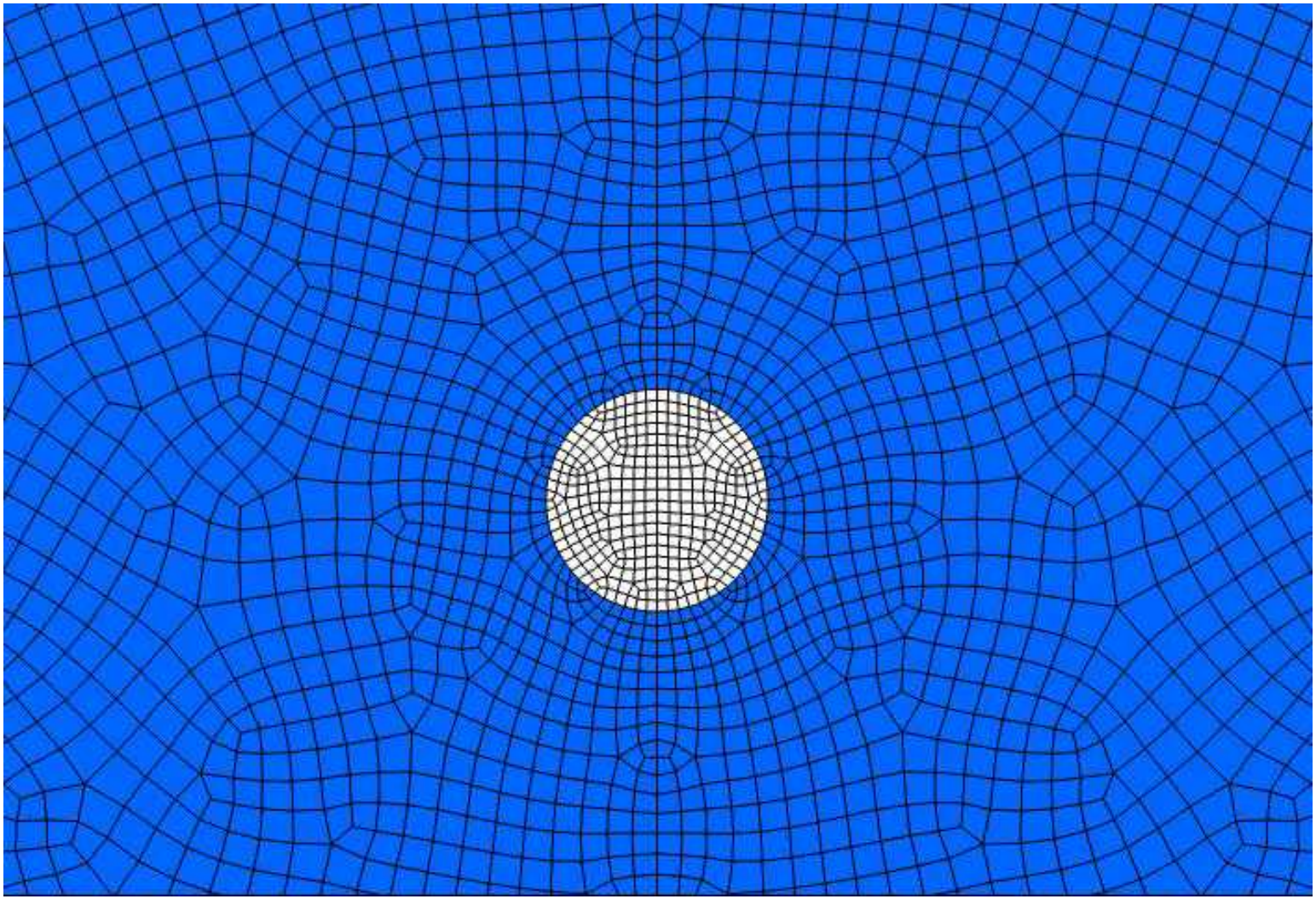
Motion of incompressible drop vs. compressible bubble

Comparison with theory

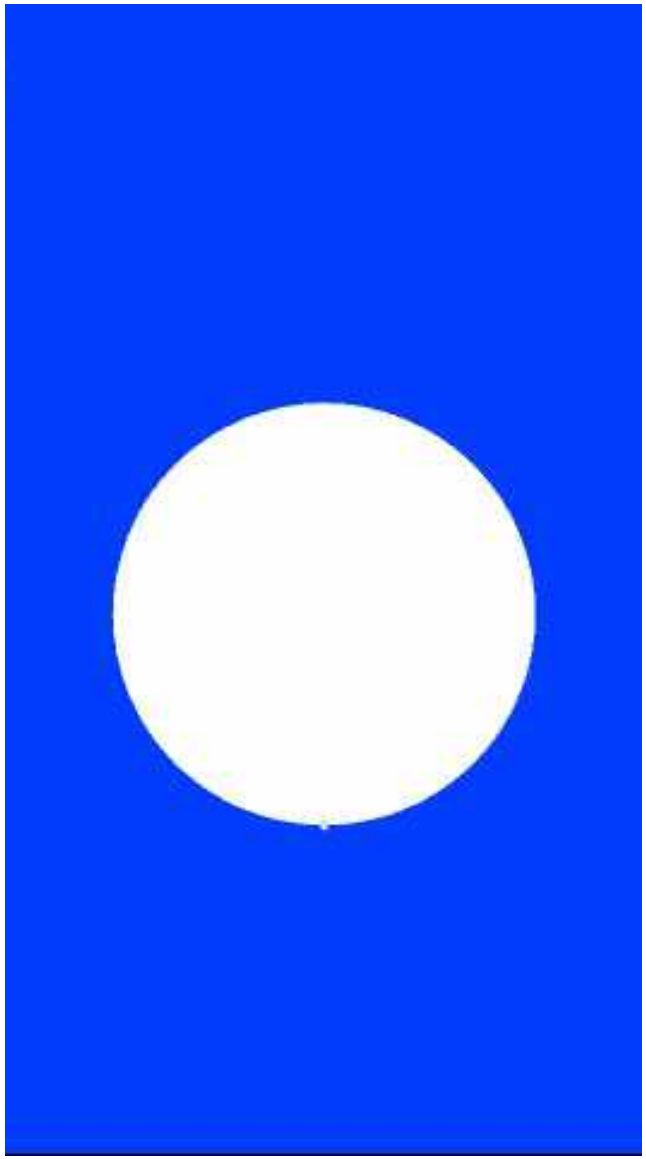
Surface instabilities generate bubbles that move away from the interface
— *against gravity*

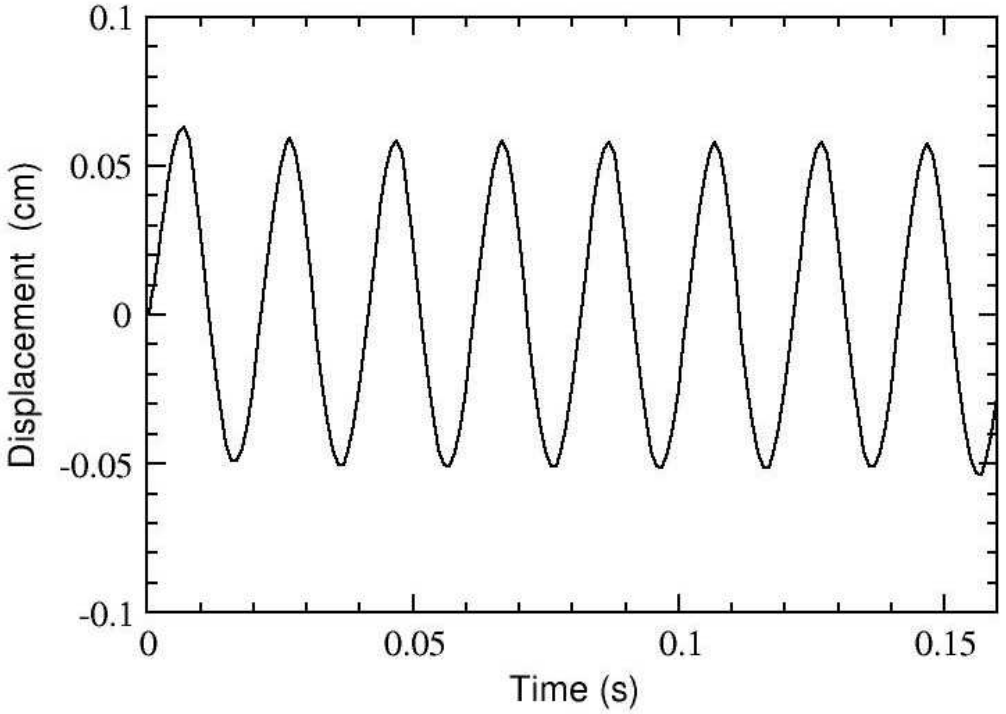
Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Finite Element Analysis
ALE (Arbitrary Lagrangian Eulerian)

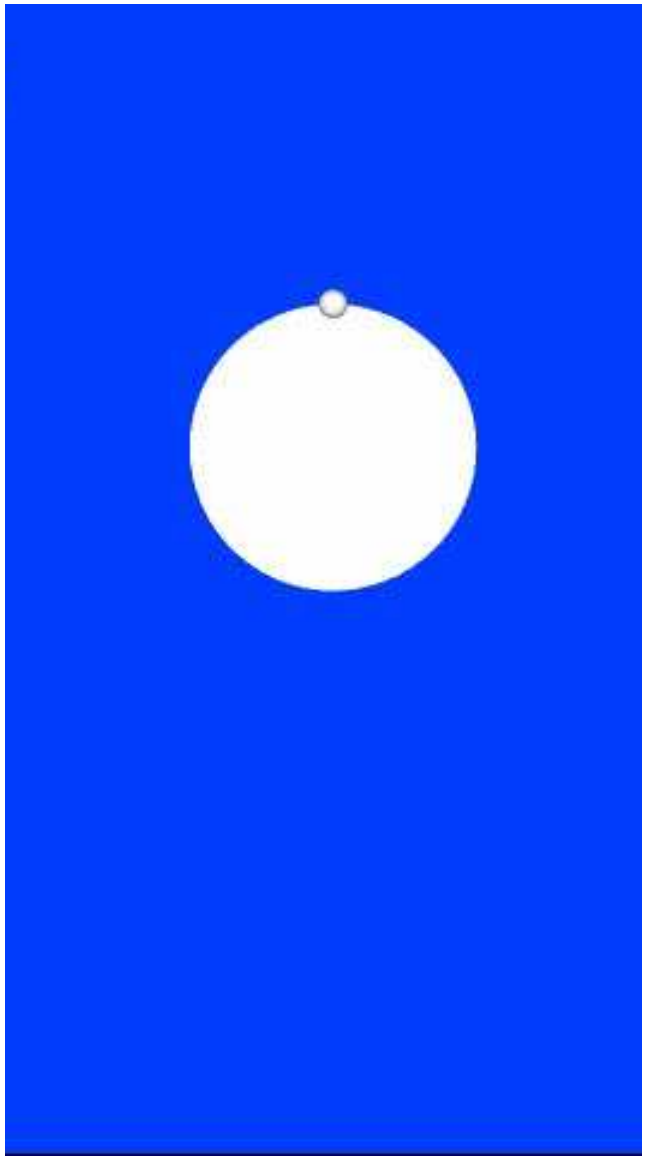


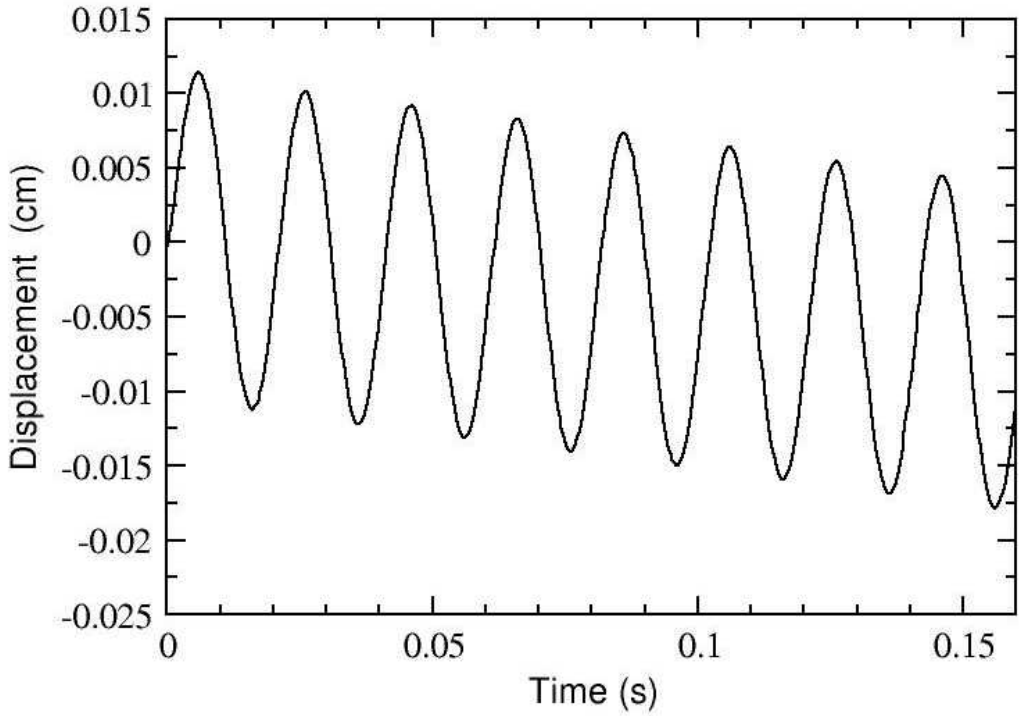
Motion of an incompressible drop in a vibrating container



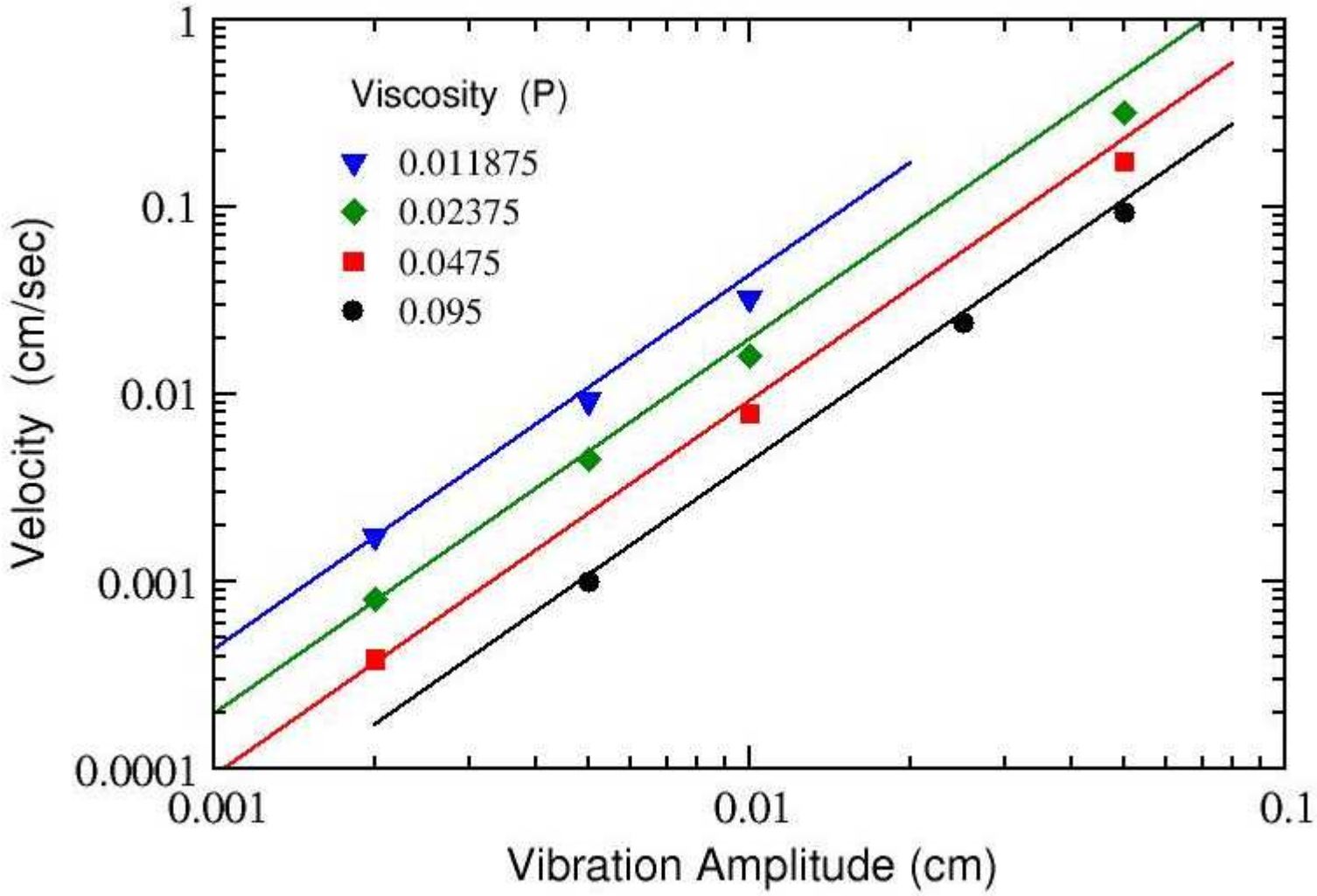


Motion of a compressible bubble in a vibrating container

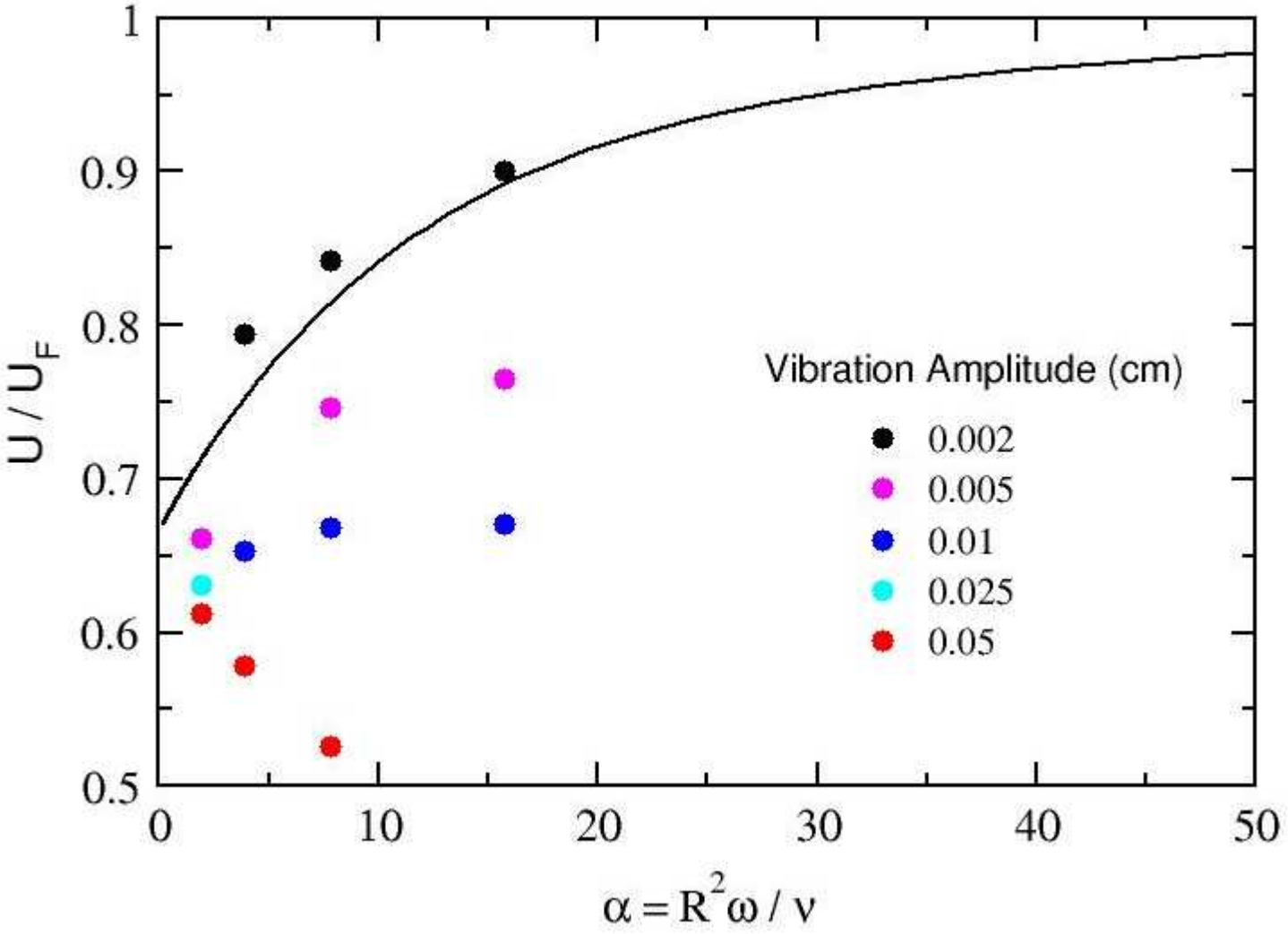




Bubble Drift Velocity – Comparison with Theory



Bubble Drift Velocity – Comparison with Theory



Conclusions

Surface instabilities generate bubbles that move away from the interface
— against gravity.

An incompressible drop does not drift.

The drift velocity for a compressible bubble and has been calculated using ALE finite element analysis.

The results agree with theory.