

Abstract Submitted  
for the DFD09 Meeting of  
The American Physical Society

**Modeling the Free Surface Penetration of Cylinders and Spheres**

SAMUEL KOSKI, Naval Surface Warfare Center Dahlgren & Virginia Tech, PAVLOS VLACHOS, Virginia Tech — Free surface penetration is a multiphase flow problem whereby a solid body is translated through a gas penetrating a liquid. The nature of the ensuing fluid dynamics poses a highly complex analytical modeling effort. It is known that for a given surface roughness, body geometry, and velocity, a cavity can be formed aft of the body and maintained for a given distance with traveling from air into water. An analytical model [Dynamics of Transient Cavities, V. Duclaux et al.] of the classical free surface penetration of spheres and cylinders and computational simulations using ANSYS CFX version 12 are performed and presented. Comparisons of the pinching (closure) and cavity radius as a function of time are considered and the effect of surface roughness is explored.

Samuel Koski  
Naval Surface Warfare Center Dahlgren & Virginia Tech

Date submitted: 10 Aug 2009

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