

# Modelling of Cavitation within Highly Transient Flows with the Volume of Fluid method

James M. Brethour\*

\* Flow Science, Inc.  
683 Harkle Road, Santa Fe, NM USA 87505  
[brethour@flow3d.com](mailto:brethour@flow3d.com), [www.flow3d.com](http://www.flow3d.com)

## ABSTRACT

Cavitation is the sudden vaporization of liquids due to rapid pressure drops within high-speed liquid flows. The presence of cavitation can cause tremendous pressure oscillations and result in significant mechanical damage. In civil hydraulics, failure to account for the potential of cavitation within dam structures can result in potentially catastrophic damage [1]. Likewise, cavitation within casting dies during high pressure die casting can result in die damage and increased maintenance and resulting part failure. Clearly, modelling cavitation and designing systems to minimize its effects are important in many industries.

This work showcases modelling of cavitation and associated phase changes within highly transient, three-dimensional free surface multiphase flows. Benchmark studies with experimental data are shown, along with examples of cavitation with real-world simulations in the fields of hydraulics and high pressure die casting. Benchmark examples presented show good agreement with regards to location and time evolution of cavitation behaviour. Forces on adjacent solid structures are also predicted.

All simulations are performed using the soon-to-be released Version 11.1 of the computational fluid dynamics (CFD) software package **FLOW-3D**<sup>®</sup>.

## REFERENCES

- [1] Falvey, H.T., *Cavitation in chutes and spillways*. A Water Resources Technical Publication, Engineering Monograph No. 42. United States Dept. of the Interior, April 1990.  
([http://www.usbr.gov/pmts/hydraulics\\_lab/pubs/EM/EM42.pdf](http://www.usbr.gov/pmts/hydraulics_lab/pubs/EM/EM42.pdf) )