# Cavitation Bubbles in Shear Flow

S. Dabiri[1*], W. A. Sirignano[1], and D. D. Joseph[1,2]
[1]Department of Mechanical and Aerospace Engineering
University of California, Irvine, CA 92797, USA
[2]Aerospace Engineering and Mechanics Department
University of Minnesota, Minneapolis, MN 55455, USA

**Abstract**

Growth and collapse of cavitation bubbles in an orifice flow is simulated in order to understand the effects of bubble deformation and size variation on the flow field. Effects of shear strain, normal strain, and pressure variation are examined. The Navier-Stokes equations are solved by a finite-volume method with a level-set method for interface capturing. Previous experimental studies have shown that cavitation inside liquid injectors improves the atomization process but the physics is not well understood. We observed that the shear in the flow causes the bubbles to deviate from a spherical shape. During collapse of the bubble, two re-entrant jets are formed on sides of the bubble which will collide with each other if the viscosity is small enough. For bubbles with larger surface tension, impingement of re-entrant jets results in breakup of the bubble. A spherical-harmonics decomposition of the velocity field shows the creation of a strong quadrupole field as the bubble collapses. In some cases, the quadrupole component of the velocity exceeds the monopole component.

Key words: atomization, cavitation, bubble dynamics, shear flow, spherical harmonics

* Corresponding author, *E-mail*: sdabiris@uci.edu