Department of Aerospace Engineering Seminar Series

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Vorticity generation and air entrainment in free surface flows

October 22, 2014 | 10:00 AM
Aerospace Engineering Conference Room, 3164 Martin Hall

ABSTRACT: Vorticity below a liquid-air interface has been recognized as a source of air entrainment and breakup. Curved free surfaces have also inherent vorticity and can be source of vorticity. Air entrainment from micro-disturbances in the liquid or gas phases has not been systematically studied and still eludes fundamental understanding. However, such processes are present in a multitude of multiphase flows found, for example, in nuclear reactors, surface ships, or environmental flows. Long-distance, micro-particle image velocimetry coupled with planar laser induced fluorescence have been developed to resolve steep mm-scale waves and bubble formation on the surface of a disturbed free surface. By providing tractable and highly resolved velocity data on bubble entrapment, this work lays the foundation for future experimental and numerical studies of multiphase flow processes. Data acquired here also facilitate the understanding of complex phenomena in turbulent free surface flows as well as the identifications and rankings of bubble sources.

BIO Philippe Bardet is an Assistant Professor at the Mechanical and Aerospace Engineering Department at the George Washington University (GW). He received his Ph.D. from the University of California at Berkeley in 2006. After his doctoral studies, Dr. Bardet was a lecturer and postdoctoral fellow at UC Berkeley, before postdoctoral training at the California Institute of Technology. He joined the Faculty at GW in August 2010. His current research is focused on understanding vorticity interaction with liquid-gas interfaces resulting in air entrainment and atomization, Fluid-Structure Interactions in nuclear reactor cores during seismic events, and developing advanced laser diagnostics. Dr. Bardet teaches courses in Fluid Mechanics, Thermodynamics, and Experimental Methods.

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