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ADVANCED NUMERICAL METHODS FOR CAVITATING FLOWS

NIKOLAUS A. ADAMS[*], STEFFEN J. SCHMIDT[*] AND ERIC JOHNSEN[†]

[*] Technische Universität München
Institute of Aerodynamics and Fluid Mechanics
Boltzmannstrasse 15, 85747 Garching, Germany
Nikolaus.Adams@tum.de, Steffen.Schmidt@tum.de, www.aer.mw.tum.de

[†] University of Michigan
1231 Beal Ave.
2015 Walter E. Lay Automotive Engineering Laboratory Ann Arbor, MI 48109-2133
ejohnsen@umich.edu, http://www.umich.edu/~ejohnsen

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ABSTRACT

Cavitation of liquids [1-3], i.e. the evaporation of the liquid due to sufficient, flow or wave-dynamics induced, pressure drop is a phenomenon of high technical relevance. Cavitation occurs in liquid-fuel injectors, and becomes increasingly important for design and safe operations with ever increasing injection pressures and alternative fuels. It affects the design of hydraulic-energy converters, ship propellers, and is a design-limiting phenomenon in modern chemical space-transportation propulsion. Moreover, it is a helpful (cleaning) and a harmful (artificial heart valves) issue for biotechnology. Physical knowledge is largely driven by an impressive long-lasting experimental activity that encounters, however, significant limitations with respect to experimental simulation of technically relevant phenomena (such as high pressures, turbulence, and very small spatial and temporal scales). As the resolution of all relevant interacting phenomena (interfaces, phase-change, wave-dynamics, turbulence) is important, a range of numerical approaches is relevant for cavitating flows. For detailed investigations of single or a few bubbles or clear cavitation sheets sharp-interface approaches are well suited, whereas for engineering prediction single-fluid mixture approaches produce adequate results see e.g. [4]. With the minisymposium we want to address the current developments of advanced numerical models of the above phenomena involved in cavitating flows, but also consider computational aspects that enable unprecedented resolution of complexity or phenomena.

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