ETH zürich

Institute of Fluid Dynamics
Institute of Energy and Process Engineering

Colloquium Thermo- and Fluid Dynamics

Inertial cavitation in Soft Matter – Friend or Foe?

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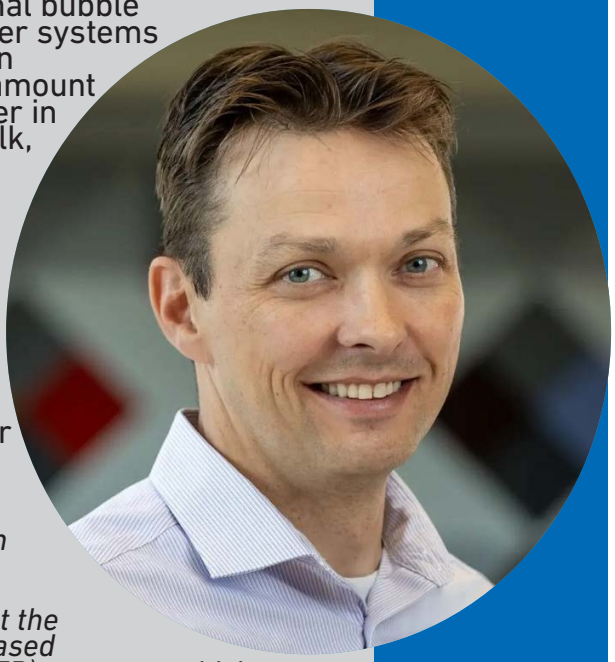
The powerful and destructive nature of cavitation has long been appreciated. From cavitation-erosion on ship-based propellers, pumps, and impellers to the prey-stunning capability of the mantis shrimp, inertial cavitation is known to generate stresses on the order of gigapascals with internal bubble pressures and temperatures rivaling our sun. For soft matter systems in particular, understanding the large, high-rate deformation response of the material during cavitation has become paramount in being able to either mitigate or carefully harness its power in a plethora of engineering and clinical applications. In this talk, I will present a two part lecture on our recent experimental developments in using inertial cavitation. In part one I will provide an overview of our previously developed high to ultra-high strain rates (103 ~ 108 s-1) microrheology technique called Inertial Microcavitation Rheometry (IMR) along with an application for characterizing the finite deformation, viscoelastic material response of porcine brain tissue. In part two part of my talk, I will discuss the potential role of inertial cavitation in the injury signature and pathology of blast traumatic brain injuries and provide the first kind of quantification of critical injury thresholds for these types of cellular injuries.



Christian Franck is the H.I. Romnes Faculty Fellow and Bjorn Borgen Professor in Mechanical Engineering at the University of Wisconsin-Madison.
He is the acting director of the Center for Traumatic Brain Injury at the University of Wisconsin-Madison and the ONR-funded «Physics-based Neutralization of Threats to Human Tissues and Organs» (PANTHER) program, which consists of over 30 PIs nationwide. His work specializes in cellular biomechanics and new experimental mechanics including unique three-dimensional full-field imaging capabilities based on multiphoton and confocal microscopy and digital volume correlation. Current application areas of these three-dimensional microscopy techniques include understanding the 3D deformation behavior of neurons in the brain during traumatic brain injuries, and the role of non-linear material deformations in soft matter

Date: Wednesday, 5 March 2025
Time: 16:15 - 17:15 h
Place: ETH Zurich, ML H 44
Host: Prof. Outi Supponen

Further information: https://ifd.ethz.ch/events/ktf.html

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