ETH zürich

Institute of Fluid Dynamics
Institute of Energy and Process Engineering

Colloquium Thermo- and Fluid Dynamics

Nonlinear resonances and mixing in liquid-sloshing experiments

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Nonlinear resonances of sloshing liquids are notoriously difficult to predict and occur e.g. in tank ships transporting liquified natural gas or in rockets using cryogenic liquid fuels. We perform fundamental sloshing experiments by oscillating a rectangular tank partially filled with water. By measuring the motion of the liquid's centre of mass, we provide direct comparisons to state-of-the-art models. We find that only a novel data-driven spectral submanifold method can predict the measured nonlinear responses. Additionally, we reveal large scale vortices which form underneath the surface. These greatly enhance mixing and should thus be included in heat transfer models of e.g. cryogenic rocket fuel.

Kerstin Avila studied physics at the University of Kiel (Germany), and got her PhD at the Max Planck Institute for Dynamics and Self-Organization in Göttingen (2014). She then joined the University of Erlangen-Nuremberg, and later the Center of Applied Space Technology and Microgravity of the University of Bremen, as postdoc. Since 2019, she is a group leader at the Chair of Particles and Process Engineering of the University of Bremen and the Leibniz-IWT. Recently, she has been offered a tenured Professorship at the Institute of Physics of the University of Oldenburg starting next semester. Kerstin's present research interests include the transition to turbulence in shear flows, pulsatile and particulate flows, sprays, free-surface flows and resonances in fluids. She combines experiments with dynamical-systems approaches and does both fundamental and applied science.

Date: Wednesday, 14 December 2022
Time: 16:15 – 17:15
Place: ETH Zurich, ML F 36
Host: Prof. George Haller, IFD, IMES

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

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