The Hong Kong Polytechnic University
Department of Applied Mathematics

Seminar

Stabilized Isogeometric Discretization of the Navier-Stokes-Korteweg Equations: Toward Predictive Cavitation Simulations

By

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Abstract

Cavitating flows are ubiquitous in engineering and science applications. Despite their significance, a number of fundamental problems remain open; and our ability to make quantitative predictions is very limited. The Navier-Stokes-Korteweg equations constitute a fundamental model of cavitation, which has potential for predictive computations of liquid-vapor flows, including cavitation inception —one of the most elusive aspects of cavitation. However, numerical simulation of the Navier-Stokes-Korteweg equations is very challenging, and state of the art simulations are limited to very small Reynolds numbers, open flows (no walls), and in most cases, micrometer length scales. The computational challenges emerge from, at least, (a) the presence of third-order derivatives in the governing equations, (b) a complicated eigenstructure of the spatial partial-differential operators in the governing equations, (c) the need to resolve the liquid-vapor interface, which without special treatment, has a thickness in the order of nanometers. Here, we present a stabilized isogeometric discretization scheme that permits, for the first time as far as we are aware, large-scale simulations of wall-bounded flows with large Reynolds numbers. We feel that this work opens possibilities for predictive simulations of cavitation.

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Date: 2 February 2023 (Thursday)
Time: 9:00-10:00 (Hong Kong Standard Time GMT +8)
Venue: Online Talk via Zoom (Meeting ID: 951 9377 5626)
Speaker: Prof. Hector Gomez, Purdue University
Host: Prof. Zhonghua Qiao, The Hong Kong Polytechnic University
Click to join:
https://polyu.zoom.us/j/95193775626?pwd=VWdZcDNnWEJUNnJTK1ZCYncza3VvZz09

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