香 港 大 學
THE UNIVERSITY OF HONG KONG

Institute of Mathematical Research
Department of Mathematics

Frontiers of Mathematics Lecture

Waving, rotating, buckling: fluid dynamics of filaments at the microscale

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Abstract

The motion of undulating or rotating filaments in a fluid environment is a common element in many biological and engineered systems. Examples at the microscale include bacterial flagella propelling a cell body and engineered helical nanopropellers designed to penetrate mucosal tissue for drug delivery. Complex fluid environments, such as polymeric networks or confining geometries, can have dramatic effects upon the dynamics of filaments, whether rigid or flexible. In this talk we will present a mathematical and computational framework used to model these viscosity-dominated flows. We will investigate a few intriguing systems: actin-like fibers in straining flows that spontaneously buckle into helices, rigid helical filaments that penetrate and break a polymeric network, and the journey of extremely long and flexible insect flagella through narrow and tortuous female reproductive tracts.

Biography

Lisa Fauci received her PhD from the Courant Institute of Mathematical Sciences at New York University, and directly after that joined the Department of Mathematics at Tulane University in New Orleans, Louisiana, USA. Her research focuses on biological fluid dynamics, with an emphasis on using modeling and simulation to study the basic biophysics of organismal locomotion and reproductive mechanics. Lisa served as president of the Society for Industrial and Applied Mathematics (SIAM) in 2019-2020. In 2023, she was elected to the US National Academy of Sciences.

Date :
June 24, 2024 (Monday)

Time :
4:30 – 5:30pm
(Tea Reception starts at 4:00 pm)

Venue :
Lecture Theatre C, LG1/F,
Chow Yei Ching Building,
The University of Hong Kong

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