Arnab Roy

Mathematical Challenges in Fluid-Structure Interaction: From Well-Posedness to Control

Short biography

Arnab Roy is an Ikerbasque Researcher and Ramón y Cajal Fellow at BCAM (Bilbao, Spain). His research interests lie in fluid mechanics, partial differential equations, and control theory, with a particular focus on fluid–structure interaction. His work addresses mathematical questions related to existence, uniqueness, stability, singular limits, and long-time behavior of solutions for coupled fluid systems. Before joining BCAM, he held positions at TU Darmstadt (as a Humboldt Fellow), the Czech Academy of Sciences, and INRIA Nancy, and obtained his Ph.D. from TIFR-CAM, Bangalore.

Short abstract of the Lecture:

In this lecture, we will introduce some fundamental questions in the mathematical analysis of fluid-structure interaction, focusing primarily on the motion of a rigid body immersed in a viscous incompressible fluid. Starting from the governing equations, we will discuss the role of energy estimates, the difficulties associated with moving boundaries, and some key ideas behind the existence and uniqueness theory.
We will then turn to control problems and explore how the motion of a rigid body can be influenced through the surrounding fluid. In particular, we will discuss a fluid-structure system governed by the Boussinesq equations and explain the main ideas underlying a local controllability result.

Finally, we will briefly highlight some further directions, including singular limits and the collective behaviour of many small rigid bodies immersed in a fluid.