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The Hong Kong University of Science and Technology

Department of Mathematics

Mathematics Colloquium

Fluid-structure interactions between rigid bodies and incompressible flow

By

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Abstract

Fluid-structure interaction (FSI) problems have drawn significant attention in recent years due to their great practical importance in aeronautical engineering, civil engineering, and biomedical engineering, among others. In this talk, I will discuss our recent study of the FSI regime involving viscous incompressible flow and rigid bodies. Such FSI problems arise in many applications of science and engineering, including particulate flows and mechanical heart valves. We begin by exposing two types of effects arising from the forces and torques on the rigid body due to fluid, referred to as added-mass and added-damping effects. A novel partitioned algorithm is then developed to handle both effects. The scheme is based on a generalized Robin interface condition for the fluid pressure that includes terms involving the linear and angular accelerations of the body. Added-damping effects are treated with approximate added-damping tensors that are defined by certain integrals over the surface of the body. In simple model geometries we prove that the proposed scheme remains stable, without sub-iterations, for bodies of any mass even when the fluid effects are large. Its extension to general geometry is performed using moving overlapping grids. A series of challenging benchmark problems are presented to verify the theoretical results and demonstrate the efficiency of the scheme.

Date: ***Tuesday, 30 January 2018***

Time: ***4:00 p.m. – 5:00 p.m.***

Venue: ***Room 4502, Academic Building (near Lifts 25&26), HKUST***

All are welcome!

The speaker is a candidate for a faculty position