

Selected Topics in Applied Mathematics

Applied and Comp Math 990

Section: G100

Term: 2013 Spring

Instructor: John Stockie (stockie@math.sfu.ca)

Discussion Topics: The immersed boundary (or IB) method is a very popular numerical approach for solving fluid-structure interaction problems involving an elastic, deformable surface or solid body immersed within a viscous, incompressible fluid. It has been shown to be practical and efficient particularly for problems in biofluid dynamics where the solid body has a complex geometry and possibly also time- or flow-dependent material parameters.

This course will place a roughly equal emphasis on: (1) theoretical aspects, including a rigorous derivation of the governing equations and a study of approximate analytical solutions and their underlying properties; and (2) computational aspects, introducing a simple finite difference approximation of the governing equations and applying the method to the study of practical problems from biology and engineering.

Topics include: incompressible flow and Navier-Stokes equations (NSEs); IB model equations; properties of the Dirac delta function; approximate analytical solutions and stability analyses; review of finite difference methods; projection method for solving NSEs; fast Fourier transform; public-domain IB software; IB model variations and extensions; practical applications; immersed interface method (and other related methods).

Grading: The course grade will be based on homework assignments and a term project.

Required Texts: C. Peskin, *Acta Numerica*, 11:1-39, 2002.

Note: This text is also available online, at no charge, through the SFU Library: [rdhttp://troy.lib.sfu.ca/record=b5232457~\\$1a](http://troy.lib.sfu.ca/record=b5232457~$1a)

Recommended Texts:

Materials/Supplies:

Prerequisite/Corequisite: The prerequisites are some knowledge in partial differential equations and numerical methods.

Notes: Note: Outline is subject to revision as indicated in the first lecture

THE INSTRUCTOR RESERVES

THE RIGHT TO CHANGE ANY OF THE ABOVE INFORMATION.

Students should be aware that they have certain rights to confidentiality concerning the return of course papers and the posting of marks. Please pay careful attention to the options discussed in class at the beginning of the semester.

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