The Mathematics of Moving Fluids

Fluid dynamics, the study of the motion of liquids and gases, is one of the classical branches of applied mathematics. Sciences such as aerodynamics, hydrodynamics, meteorology and oceanography, to name a few, draw heavily on the mathematics of fluid mechanics for their quantitative underpinnings. The central theme of this class is the development of the mathematics for understanding the basic variables that describe the motion of fluids: flow velocity, pressure and density.

The modelling of fluids applies ideas from ordinary and partial differential equations, complex analysis and a bit of numerical analysis. The core aims for the term are: deriving the equations of motion from basic physical principles, developing differential equation techniques for finding special solutions, and most importantly, interpreting these solutions in the context of understanding fluids. Computer visualization will be an important accompaniment to the lectures and assigned work. The rudiments of numerical computing and graphics will be introduced through the use and modification of downloadable Matlab scripts.

The ultimate goal is to use mathematics to reveal, in a quantitive way, the mysteries of the motions of liquids and gases. Why does water swirl as it drains from the bathtub? Why is there a speed of sound? Why does a baseball pitcher's curve-ball curve?

Professor: David Muraki, office K10538, phone 604.291.4814

Lectures: monday at 2:30-3:20pm in AQ 3154
wednesday at 3:30-5:20pm in AQ 3149

Office Hours: tuesday 3:00-5:00pm
or by special appointment (arrangements by phone/e-mail)

Reading: *Elementary Fluid Dynamics*
D.J. Acheson, Oxford (1990)

Webpage: visit *www.math.sfu.ca/∼muraki* & follow class link
updated weekly — assignments, computing demos & announcements
link to online notes from main library

Communication: webct-based discussion postings as primary class e-mail
muraki@sfu.ca: private class-related e-mail correspondence only
muraki@math.sfu.ca: urgent correspondence only please

Computing: Matlab is the recommended computing environment
lecture & homework scripts will be posted on class webpage
Matlab accessible via campus network & assignment lab (AQ3144)

Responsibilities: weekly assignments ($\approx 40\%$)
active participation in class & webct discussions
midterm ($\approx 25\%$) & final exam ($\approx 35\%$)