

### 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 quantitative 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?

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- Professor:** David Muraki, office K10538, phone 604.291.4814
- Lectures:** monday & wednesday at 2:30-4:20pm in AQ 4130 (subject to change)
- Office Hours:** tuesday 3:00-5:00pm  
or by special appointment (arrangements by phone/e-mail)
- Reading:** *Elementary Fluid Dynamics*  
DJ Acheson, Oxford (1990)
- Webpage:** visit [www.math.sfu.ca/~muraki](http://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@fraser.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)  
PC student versions can be ordered from [www.mathworks.com](http://www.mathworks.com)
- Responsibilities:** weekly assignments ( $\approx 40\%$ )  
active participation in class & e-mail discussions  
midterm ( $\approx 25\%$ ) & final exam ( $\approx 35\%$ )