

Fluid Dynamics

Fall 2016, Graduate course

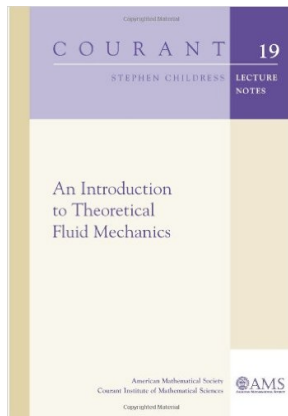
Wed 1:25pm–3:15pm, room 512 WWH

Instructor: Oliver Buhler, room 1013 WWH

obuhler@cims.nyu.edu

Textbook: ***An Introduction to Theoretical Fluid Mechanics***,
Stephen Childress, AMS (Courant Lecture Notes 19) (2009)

Prerequisites: undergraduate PDE.



Aqueducts in Roman times, steam engines, airplanes, waves and currents in the atmosphere and ocean, swimming and flying, the flight of a soccer ball, and the swirling of galaxies. These are all physical topics in which mathematical Fluid Dynamics plays a decisive role. Moreover, problems in Fluid Dynamics have prompted many developments in mathematics, making its study a convenient gateway to advanced methods in the field.

This graduate class will develop the fundamentals of Fluid Dynamics that underpin physical applications in active research fields at the Institute. Our focus will be to develop the best mathematical tools available in order *to understand the phenomenon*.

The plan is to follow the first eight chapters of the textbook, which covers fundamentals of incompressible flows such as the fluid continuum, conservation of mass and momentum, vorticity, potential flows, lift and drag, viscosity, Stokes flows, and boundary layers. Thereafter, additional topics will be covered according to interest, with possible topics including: surface waves, rotating and stratified flows, compressible flows (sound waves and shocks), and turbulence.

Regular homework will be assigned. No prior knowledge of physics is assumed, but you need to be very comfortable with multivariable calculus and elementary PDE theory.