MTH 619 TOPICS IN ANALYSIS - Spring 2018

Class Meetings MWF 3:00-3:50 pm in BEXL 416

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Text There is no required text. Recommended texts include:
- Elementary Fluid Dynamics, by D.J. Acheson
- Vorticity and Incompressible Flow, by A. Majda and A. Bertozzi
- (for background material) Methods of Applied Mathematics by Todd Arbogast and Jerry L. Bona, which can be found here: https://www.ma.utexas.edu/users/arbogast/appMath08c.pdf

Course Webpage http://people.oregonstate.edu/˜cozzie/MTH619S18.html
The first-day handout, problem sets, and other course materials will be posted on the course webpage.

Course Content This course is an introduction to the mathematical theory of incompressible fluid flow. We will study the Navier-Stokes equations (modeling incompressible viscous fluid flow) and the Euler equations (modeling incompressible inviscid fluid flow) in both two and three dimensions.

The course will begin with an introduction to properties of the equations and important physical quantities associated with incompressible fluid flow (velocity, vorticity, pressure, particle trajectory map, stream function). We will then derive and thoroughly analyze the vorticity formulations of the Euler and Navier-Stokes equations in two and three dimensions.

The remainder of the course will focus on 1) existence and uniqueness theory for solutions to the Navier-Stokes and Euler equations and 2) the inviscid limit of solutions to the Navier-Stokes equations. Regarding existence/uniqueness, we will focus primarily on the theory for classical solutions. In our discussion of the inviscid limit (which will likely be somewhat brief), we will work mainly in domains with boundary and highlight some of the challenges resulting from the presence of the boundary.

Prerequisites MTH 512 or instructor permission.

Problem Sets You will hand in three problem sets during the term. The (very) tentative due dates for these problem sets are April 27, May 18, and June 8.
Learning Outcomes Upon completing MTH 619, the successful student is expected to be able to:

- state the Navier-Stokes and Euler equations and derive their corresponding vorticity formulations.
- understand and apply properties of the physical quantities associated with incompressible fluid flow, such as the velocity, vorticity, and particle trajectory map.
- understand and apply concepts related to vortex dynamics for inviscid flows.
- understand and apply concepts related to existence and uniqueness theory for the Navier-Stokes and Euler equations.
- understand and apply concepts related to the inviscid limit of solutions to the Navier-Stokes equations.

Students with Disabilities Accommodations for students with disabilities are determined and approved by Disability Access Services (DAS). If you, as a student, believe you are eligible for accommodations but have not obtained approval please contact DAS immediately at 541-737-4098 or at http://ds.oregonstate.edu. DAS notifies students and faculty members of approved academic accommodations and coordinates implementation of those accommodations. While not required, students and faculty members are encouraged to discuss details of the implementation of individual accommodations.

Academic Honesty Students are expected to be familiar with Oregon State University’s Statement of Expectations for Student Conduct. Please review this statement at http://oregonstate.edu/admin/stucon/achon.htm