MATH4326 Introduction to Fluid Dynamics

Time: Mon., Wed. 10:30-11:50
Venue: 1511
Office Hours: Tue. 14:30-15:30 (Rm3451)
Instructor: J. Gan
Ext: 7421
Email: magan@ust.hk
Tutorial: Mo 03:00PM - 03:50PM
Venue: 2463
Instructor: Xing Ji
Email: xjiad@connect.ust.hk

Texts:

Class notes
(http://www.math.ust.hk/~magan/MATH4326/interface.htm)
D. J. Acheson, ***Elementary Fluid Dynamics***, Clarendon Press, Oxford, 1990.

Reference:

G. K. Batchelor, ***An Introduction to Fluid Dynamics***, Cambridge University Press, 2000.

Grading Scheme:

Class participation: 10%

Assignments: 15%

Mid-Term Exam: 20%

Final Exam: 55%

Course Content:

The basic concepts in the fluid dynamics

Application of fluid dynamics
Properties of fluids
Viscosity, friction and ideal flow
Laminar flow and turbulent flow
Compressible and incompressible flow
Subsonic and supersonic flow
Stratified and non-stratified flow

Equations of motion

Forces acting on a fluid
Total differentiation
Eulerian and Lagrangian coordinates
Euler Equations and Navier-Stoke equations
Continuity equation
Scaling parameters

Circulation and vorticity

Circulation, vorticity, Stoke theorem and vorticity equation
Examples of viscous flows
Kevin circulation theorem
The persistence of irrotational flow
The Prandtl-Batchelor Theorem

Waves

Properties of waves

Dispersion and group velocity

Simple wave types

The perturbation method

Simple wave types

capillary waves, sound waves, shallow-water gravity waves

hydraulic jumps and solitary waves

Aerofoil theory

Introduction

Velocity potential and stream function

Complex potential

Irrotation flow past a circular cylinder

Boundary layer theory

Viscous regions in high Reynolds number flow

The steady 2-D boundary layer equations

Rotating flows controlled by boundary layers

Boundary layer separation and attachment