

DEPARTMENT OF MATHEMATICS, UAB
PDE MODELLING
MA561, Spring 2013

Instructor. Dr. Ian Knowles, Room 481A, Campbell Hall, iknowles@uab.edu, (205) 934-2154.

Office Hours. After class, or drop in anytime, or email for an appointment.

Prerequisite Course. MA227, or permission of instructor.

Class Meetings. MWF: 9:00-9:50am, Room HHB221.

Grading. The course is divided into modules, with approximately one programming assignment for each module; there will be also be a larger project/term paper worth two assignments due at the end of the term. The course grade is calculated solely from the assignments and the project.

Course Outline:

- Practical examples of partial differential equations, including Poisson's equation, the heat/diffusion equation and the wave equation; discussion of boundary conditions and their practical interpretation.
- Derivation of partial differential equations from physical laws.
- Introduction to MATLAB and its PDE Toolbox, and COMSOL
- Introduction to finite difference and finite element solution methods.
- Continuum mechanics and linear elasticity.
- Fluid flow and the Navier-Stokes equations; class boat race.
- The Maxwell equations and electromagnetic waves.
- Specialized modelling projects in topics such as heat flow, groundwater modelling, scattering of plane waves, medical and industrial imaging, fluid mechanics including hurricane simulation, and acoustic and electromagnetic applications.