Survey of Applied Mathematics Techniques

Brian Wetton
Mathematics Department, University of British Columbia
www.math.ubc.ca/~wetton

We will consider simple one dimensional ODE boundary value problems as a framework in which to describe standard techniques of Applied Mathematics: scaling and asymptotics, numerical approximation, and analysis by series solutions and Green's functions. Specific topics covered by lectures:

1. Introduction, Finite Difference (FD) approximation, Green's functions.
2. Convergence of FD approximation. Handling Boundary Conditions.
3. Scaling and non-dimensionalization. Nonlinear problems.
4. Series solutions. Sturm-Liouville theory. Spectral Methods.
5. Collocation methods (MATLAB bvp4c function).
6. Asymptotic Analysis.
7. Finite Element Method.
8. Time dependent problems.
9. Cahn Hillard Equations.

Several examples will be considered. MATLAB codes will be provided. Topics and the speed at which they will be covered may vary to suit the level and interest of the audience.