

Beyond Separation of Variables: Exact & Approximate Techniques for Solving PDEs

The simplest approach to solving PDEs (partial differential equations) is the method of separation of variables. The course discussion will begin from a natural extension of separation that leads to integral solution techniques, which includes the Fourier and Laplace transform. Investigation of this solution perspective will establish the close connection between complex variable theory and differential equations. Another class of exact integral techniques are based upon the convolution or Greens function methodology. These integral-based approaches also offer an elementary entry into the realm of special functions.

In many cases, the understanding and interpretation of exact solutions requires numerical computation and/or further approximation. The study of asymptotic and perturbation methods provide a systematic framework for the approximate analysis of PDE solutions. Here, the presentation will begin from the far-field approximation of integral solutions, and continue onto developments in multiple-scale, averaging and boundary-layer methods.

Lectures will be based upon a *case-study* approach of PDE examples. Computational illustration will be an important tool for the lectures and assigned work. The rudiments of numerical computing will be developed through the use and modification of downloadable Matlab scripts.

- Professor:** David Muraki, office TLX 10538, phone 604.291.4814
- Lectures:** MW 3:30-5:20pm in AQ 5015
- Office Hours:** thursday 3:30-5:00pm
by appointment (arrangements by phone/e-mail)
- Readings:** *Introduction to Perturbation Methods*
M H Holmes, Springer-Verlag (1995)
- Webpage:** visit www.math.sfu.ca/~muraki
- E-Mail:** essential channel for class communications
apma-900@sfu.ca: central class e-mail address
muraki@fraser.sfu.ca: private class-related e-mail correspondence
muraki@math.sfu.ca: urgent correspondence only please
- Computing:** Matlab is the recommended computing environment
lecture & homework scripts will be posted on class webpage
Matlab is accessible from the computer lab in AQ 3144
PC student versions available from SFU bookstore
- Responsibilities:** weekly assignments
active participation in class & e-mail discussions
final project – poster session