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Mathematical Methods of Physics I

Instructor

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Place and Times

Monday, Wednesday and Friday, 10-11am
L5, Howey Physics Building

Course Description

The course provides an overview of complex analysis, vectors and matrices, integral transformations, perturbation theory, ordinary and partial differential equations with applications to various physics problems.

Homeworks

There will be one homework assignment per week. Completed assignments will be due on Fridays in class. You can discuss problems with each other, but the solutions have to be executed and submitted individually. All students are expected to comply with the academic honor code. There will be no exams, your performance will be assessed based on the homeworks, so day-to-day participation is very important.

Syllabus

- Functions of complex variables
    - Complex variables
    - Conformal maps
    - Calculus of residues
- Integral and discrete transforms
    - Fourier transform
    - Hilbert transform

- Linear operators and matrices
  - Eigenvalue problem
  - Properties of eigenvectors and eigenvalues
  - Normal modes
  - Matrices and linear ODEs
- Perturbation theory
  - Asymptotic evaluation of integrals
  - Algebraic equations
  - Eigenvalue problem
  - Differential equations
  - WKB theory
- Differential equations
  - Separation of variables in PDEs
  - Boundary value problem
  - Sturm-Liouville problem
  - Rayleigh-Ritz method
  - Green's function for ODEs
  - Green's function for PDEs
  - Ill-posed boundary value problems

Homework Problems

- assignment #1 (due 09/06/13) solutions
- assignment #2 (due 09/13/13) solutions
- assignment #3 (due 09/20/13) solutions
- assignment #4 (due 09/27/13) solutions
- assignment #5 (due 10/04/13) solutions
- assignment #6 (due 10/11/13) solutions
- assignment #7 (due 10/18/13) solutions
- assignment #8 (due 10/25/13) solutions
- assignment #9 (due 11/01/13) solutions
- assignment #10 (due 11/08/13) solutions
- assignment #11 (due 11/15/13) solutions
- assignment #12 (due 11/22/13) solutions