School of Mathematics

Course 464b - Numerical methods (SS Theoretical Physics JS & SS Mathematics)

Lecturer: Dr. M. Peardon

Requirements/prerequisites: 464a

Duration: Second semester (10 weeks)

Number of lectures per week: 3

Assessment: Students can choose to complete an optional assignment (which counts 20%) or to be assessed solely by examination.

End-of-year Examination: 2-hour end of year exam

Description: This course, a continuation of course 464a, aims to give an introduction to solving problems in theoretical physics and related subjects using numerical methods. The emphasis is on practical solutions and implementations on the computer. Software will be developed during the course using the C programming language.

- **Classical algorithms for numerical integration** Starting with the simplest Newton-Cotes rules, more advanced methods for solving integral problems in one-dimension are described such as Romberg integration. Gaussian quadrature is then described.
- Monte Carlo methods The basic ideas needed to make stochastic estimations of integrals (and sums) is presented, with an emphasis on high-dimensional integrals. The Metropolis algorithm is described and applications are presented. The Ising model is presented as an example. Finding the minimum of a function using simulated annealing is described.
- Advanced algorithms for solving sparse linear systems A few advanced techniques for solving large, sparse linear systems are defined. The Conjugate gradient method is presented.

See http://www.maths.tcd.ie/~mjp/464/ for additional details.

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