PHYS 416 – Computational Physics – Spring 2007

Instructor: Frank Toffoletto (toffo@rice.edu)
Time: Tuesday/Thursday, 1:00 – 2:20 pm & 2:30 – 3:50
Location: Sewall 207 (Also known as Symonds 1)
Website: http://www.owlnet.rice.edu/~phys416/

Introduction

This course is meant to be a hands-on introduction to the various computational techniques that can be used in physics. It is not meant to replace a formal and rigorous course on numerical methods or to be a course that where you learn the latest modern practices in computer science. In this course, we will tackle a variety of interesting, real-world physics problems using computational techniques. Although most traditional physics courses concentrate on examples and problems for which elegant analytic solutions exist, most real world problems require the use of numerical techniques. As with anything, when you attempt to use such techniques, there are tradeoffs. It is often the case that the computer has generated for you a numerical solution for some problem, however unless you have a rigorous proof of convergence, you can never be sure that the answer you have is correct. In many cases a convergence proof is simply not practical, so in attacking some of the kinds of problems we hope to do in this course you should develop a healthy amount of skepticism coupled to a fair bit of intuition on the problem you are doing.

Rather than using the traditional formal lecture format that can be rather boring and unproductive, I have decided to make the course hands-on: I believe the best way to learn something is to actually do it. You will work though various problems and exercises in the book which will consist mostly of programming along with the occasional calculation.

Grading

70% of the will come from assignments. They will be graded based on criteria that include the quality of the program and algorithm, comments and documentation and results.

There will also be a **major project** that will be due somewhere before the beginning of the last month of classes. Details to follow. The project will be worth 30% of the final grade.

Textbook

The textbook will be Alejandro L. Garcia, *Numerical Methods for Physics*, (Prentice Hall, Englewood Cliffs NJ, 2000) ISBN 0-13-906744-2, LC Call No.: QC20.G37 2000. The book has a website for downloading programs, etc. The URL for the programs is:

http://www.algarcia.org/nummeth/Programs2E.html

There is also an errata, located at:

http://www.algarcia.org/nummeth/errata_NM2.pdf

Programming Languages

One of the advantages of the Garcia book is that it gives examples in 3 programming languages: MATLAB, C++ and even Fortran (from the website). You are free to choose whatever programming language you are most comfortable with, and if you are unsure I would recommend MATLAB for its versatility and ease of use. If you do decide to tackle the programming exercises on C++ or Fortran you will likely use MATLAB for graphing purposes.

Students with Disabilities

Any student with a documented disability needing academic adjustments or accommodations is requested to speak with me during the first two weeks of class. All discussions will remain confidential. Students with disabilities will need to also contact Disability Support Services in the Ley Student Center.

Late Policy

Unless there are mitigating circumstances, assignments will be due at specified dates. Any work handed in late will have the grade reduced by 10% for each part of a day late, up to 50% off.