Information about the course

I will communicate with each student regularly by email, and information about the course and the course materials are posted on the course web page at:

physics.byu.edu

Texts

There are two texts for this course.

(i) *Computational Physics 430*, the lab manual for the course, is available at the BYU Bookstore. This text contains explanations and the assignments for each laboratory period. As you work through the manual you will learn how to turn problems involving ordinary and partial differential equations into linear algebra problems, and you will also more fully develop your programming skills. You will also gain a better understanding of partial differential equations as you use computer graphics, and especially animations, to display their solutions.

(ii) *Introduction to Matlab*, available by request at the BYU Bookstore. (You should already have a copy if you took Physics 330.) If you need this manual you will need to request them to print it from the Spring materials for Physics 330. This will be a useful language reference manual to help you as you program in Matlab.

Finally, you should consider buying the student editions of Maple and Matlab while they are still cheap because you have a student ID. These two pieces of software become much more expensive when you graduate.

Course objectives

The course objectives are that you will (i) learn to use loops, logic commands, and other programming techniques to solve partial differential equations; (ii) that you will gain a better understanding of what partial differential equations mean; and (iii) that you will learn to apply linear algebra to physical systems described by data on grids.

Reading quizzes

The lab material in this course is more difficult than the material in Physics 330, so you will need to spend 1/2 hour, or so, reading each lab before you come to class. I will pass out a short reading quiz at the beginning of each period to encourage you to meet this requirement. Your performance on these quizzes will affect your grade. If you just show up and try to learn as you go, you will most likely fall behind.

Laboratory work

The reason that this course is taught as a lab instead of as a lecture/homework course is that it can take hours to find and fix simple programming mistakes without the help of trained professionals. Furthermore, the lab setting provides an active learning environment
where problems are encountered, discussed by lab partners, TAs, and the instructor, then solved. Occasionally mini-lectures at the board in the classroom will be given to explain difficult concepts or to teach good programming practice. **So come to class.** Experience has shown that if you don’t, you will almost certainly do poorly in the class. Grades of UW and E are the usual result of not showing up.

Finally, we have learned by sad experience that it is the nature of nearly all 430 students to fall behind. On the course calendar are listed 3 checkpoints. All lab work must be caught up by the end of the class period on the checkpoint day.

**Grading**

Your grade in the course will be determined by three things.

(i) Your performance on the laboratory exercises. You will be graded mostly on how many you complete, but I will also assess your understanding of the lab material as the course progresses by periodically asking questions.

(ii) There will be two short take-home exams given during the semester. These will consist of a problem, or two, to be solved using the computational methods you have learned up to that point in the course. After you complete the exam you will come to my office to show me what you have done. I will ask questions, help you fix mistakes, and assess your performance on the exam. Please come prepared to discuss any interesting effects you find in your solution.

(iii) There will be a final exam during our scheduled final exam time. The first part will be closed book and will consist of about 15 terms taken from the index of the lab manual *Computational Physics 430*. I will give you about an inch of space to write, or draw, enough about each term to convince me that you understand what it means. The second part will have about four short programming exercises in Matlab. This part will be open book, meaning that you can use both *Introduction to Matlab* and *Computational Physics 430*. You will not use a computer, but will just write Matlab commands on paper. I will give you some problems to solve and you will be expected to describe an algorithm to solve them, and then write a little bit of Matlab code to show that you know how to turn the algorithm into a working script.

Most of the grades in the course will be A and A-. An A means that you have completed all of the laboratory exercises and have shown that you have mastered the material. An A- means either that you got behind and missed a lab, or two, or that your performance on the exams has shown that you aren’t proficient at writing good code and at finding and fixing programming mistakes. Not understanding the basic physical concepts associated with partial differential equations will also lower your grade. Poor performance on the exams might lower your grade into the B-range.