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Textbooks –  *Learning MATLAB and Numerical Analysis Through Examples*, which is on the Carmen website for this course  
*A MATLAB Tutorial*, which is on my webpage

Course Content –
This is a new undergraduate course in numerical analysis which contains the standard topics that can be found in a “real” numerical course, but also contains lots of problem solving. Students taking this course are almost exclusively in some area of “applied mathematics” including (but not limited to): applied track, bio math track, financial math track, math/accounting, math/business, math/computer science, or math/statistics. Most of these are connected, in one form or another, to technical areas of the “real world” --- and the “real world” is messy! Most of the problems you will encounter cannot be solved analytically (although you might not think so from your coursework), but must be solved numerically. And MATLAB is an excellent computer language to use in their solution.

This course will start with an introduction to, or a review of, MATLAB (depending on your background). Most undergraduates at OSU have a foreign language requirement for graduation. They can treat it as a dead language (pass the required courses and never use it again) or a living language. On the other hand, in Europe foreign languages are living languages because most people can reach a foreign country within a few hours by car or train, and almost certainly within one hour by plane. In this course you will learn MATLAB as a *living* computer language.

The second component of this course is problem solving. You will be exposed to many different types of problems, in many different technical areas, using MATLAB. The problem solving will be drawn from many disciplines, including mathematics, physics, biology, and economics; it will be taken primarily from my soon-to-be book. This will improve your problem solving skills, and your MATLAB skills, and it might even be somewhat fun.

The third component of this course is numerical analysis. The topics are the “standard” ones found in most undergraduate numerical analysis courses: round-off errors, the solution of linear systems of equations, linear least squares problems, interpolation, solution of nonlinear equations and nonlinear systems of equations, numerical differentiation and integration, initial-value ordinary differential equations, and boundary-value ordinary differential equations. (Other topics can be included at the request of students.) Each topic will be connected with the appropriate MATLAB commands using “somewhat practical” problems.

Computer Language –
The computer language of instruction in this course is MATLAB. It will be covered at the beginning of the course using my soon-to-be book as well as my tutorial. MATLAB is an interactive software package which was developed to perform numerical calculations on
vectors and matrices. Initially, it was simply a MATrix LABoratory. However, today it is much more powerful:

- It can do quite sophisticated graphics in two and three dimensions.
- It contains a high-level programming language (a “baby C”) which makes it quite easy to code complicated algorithms involving vectors and matrices.
- It can numerically solve nonlinear initial-value ordinary differential equations.
- It can numerically solve nonlinear boundary-value ordinary differential equations.
- It contains a wide variety of toolboxes which allow it to perform a wide range of applications from science and engineering. Since users can write their own toolboxes, the breadth of applications is quite amazing.

In this course you will write lots of “reasonably short” computer programs in all aspects. And you will be taught how to program “well” in MATLAB. The “philosophy” of this course is that you should know the analytical algorithms which are used to solve many of the standard problems in numerical analysis, how to actually solve these problems numerically, and how to explore “interesting” mathematical models.

Note: You will be writing lots of short programs in class on your computer, so bring along a USB flash drive to save them.

Note: Some courses at OSU are designated writing courses, and students are expected to write a lot. I have designed this to be a coding course, and you will do lots of coding. In addition, I will be critiquing your coding and taking off points for anything I consider “bad programming style.” In particular, never use the inline function.

OSU has a site-license for this software. As discussed at http://cio.osu.edu/communications/community/2006/matlab.html), students can get a copy of MATLAB and SIMULINK from Customer Services in the basement of Central Classroom.

Course Rationale –
In the early days of computing when we all typed our programs on keypunch machines in a large room in the computer facility, there was usually a large line printer, i.e., a high speed impact printer which printed one line of type at a time, against one wall, and you could usually find the acronym GIGO or GIGO or even GIGO on at least one wall. It is short for Garbage In, Garbage Out and was a warning that the computer would happily (anthropomorphizing these pieces of metal and silicon) execute even the most nonsensical program and return equally nonsensical results. Charles Babbage (1791-1871), who originated the concept of a programmable computer, once wrote:

On two occasions I have been asked, “Pray, Mr. Babbage, if you put into the machine wrong figures, will the right answers come out?” In one case a member of the Upper, and in the other a member of the Lower, House put this question. I am not able rightly to apprehend the kind of confusion of ideas that could provoke such a question.

MATLAB is also quite “happy” to execute even the most nonsensical program. One of my goals for this course is that afterwards you will be able to write “good programs” so that MATLAB will generate “good output”.

Prerequisites –
It is assumed that you have some familiarity with linear algebra and the analytical solution of ordinary differential equations. There is no requirement that you know MATLAB, or any other computer language (although it would probably help).

Attendance –
Attendance is not required in class (except, of course, for the tests and the final exam). 😊 However, there is a different problem that sometimes arises in this computer lab: students who are here in body but not in spirit. 😊 The World Wide Web often behaves like the Sirens of Greek mythology who lived on the island of Sirenum scopuli: their captivating voices lured sailors who heard their beautiful songs over the water to sail directly for the island and shipwreck on the rocky coast. The computer screens in front of you can have the same effect. When you are in class, you are expected to be devoting at least some of your attention to the class. If it is clear that you have been overcome by the captivating attraction of the WWW, I have the right to tell you to cut it out.

Homework –
Homework will be assigned every Friday and will be due the next Friday at the beginning of class. I will be 😔 very 😔 unhappy about receiving late homework. (If you have to be out of town for an extended period of time, which occasionally happens, let me know beforehand and we can work something out.)

➡️ Some - actually, a lot - of the homework will be computational and you will be expected to tell me what you did so that I can understand it.
➡️ It is expected that your computer codes run CORRECTLY! In many, if not most of course codes, you will know exact results, and so it will be easy to tell if your program is WRONG. You will not get much partial credit for INCORRECT programs!
➡️ Just giving me tables of numbers and assuming that I am a mindreader will not be acceptable.
➡️ Just giving me oodles of plots and assuming that I am a mindreader will not be acceptable.
➡️ Include the computer code with your results. (Any problem turned in without the code listing will not be graded.) However, this is not an acceptable substitute for explaining what you did!

Homework rules:
(1) All parts of a problem must be together - not spread out throughout all the problems.
(2) All the problems must be held together by a staple or clip so that they don’t fall apart.

Plagiarism –
A problem which, unfortunately, occurs occasionally is that of plagiarism. You are expected to write your own computer programs, although you are certainly free to discuss them with other students, and you are free to try to get other students to help you debug your programs (free food and/or liquid refreshment is a good inducement). However, the programs must be your own, not source code from other people, textbooks (or accompanying CDs), or web sites. (Of course, you are free to use any codes presented in class or contained in my textbook.) Program plagiarism will be suspected if two students’ programs are identical up to simple transformations, or if a student cannot explain how his or her program works. In particular, if you give your code to other students “just to look at”, you are in serious trouble if they turn it in as their own work.

Note: The reason I want you to include computer listings with your homework is not
because I want to search through everyone’s programs and check for plagiarism.

Tests – There will be two tests as well as a two-hour final exam on Tuesday, Apr 30, at 4:00 pm.

There are always two questions that I am asked before tests: “What topics will be on the test?” and “How many questions will be on the test?” My response here will not stifle these questions, but here goes anyway. My response to the second question is “Enough!”

As to the first question, I could say that you are of course responsible for everything the course - but I won’t. (Of course, I just did.) You will have lots of homework in the course, not because I am a tyrant (although I am), but because in my humble opinion the way you learn the material is not by sitting passively and listening to my pearls of wisdom (although they are) but by actually doing stuff yourself and if you can do the stuff then you probably have learned the material (to some degree) while if you can’t do the stuff then you probably haven’t learned the material (to the degree you should) and so you need to work on it more - and so I choose the homework based on what is in my even humbler opinion the most important material in the course. From this incredible run-on sentence, you can probably surmise that if you understand the material well then you will probably do well on the tests. However this does not mean that you should just memorize (this is supposed to be a boat sinking) the homework solutions, but that you should understand (this is supposed to be a boat floating) the material behind the problems.

Of course, if I jump up and down and yell „Achtung. Achtung. Verstehen Sie Dieses Material!!!“, then (even if you don’t know German) you should not be surprised if you see the material on a test.

Grade –

The course grade is made up of the homework (30%), the tests (20% each), and the final exam (30%).

Disability Statement

Students with disabilities that have been certified by the Office for Disability Services will be appropriately accommodated, and should inform the instructor as soon as possible of their needs. The Office for Disability Services is located in 150 Pomerene Hall, 1760 Neil Avenue; telephone 292-3307 and VRS (614) 429-1334; webpage http://www.ods.ohio-state.edu.

Academic Misconduct Statement

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term “academic misconduct” includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee. For additional information, see the Code of Student Conduct: http://studentaffairs.osu.edu/resource_csc.asp