

DOWNLOAD PDF FRESHMAN ENGINEERING PROBLEM SOLVING WITH MATLAB

Chapter 1 : Essential MATLAB for Engineers and Scientists, 6th Edition - PDF Free Download - Fox eBook

visit author page. John Vaccaro grew up on Long Island in Levittown, New York. After graduating with a B.S. in mechanical engineering from Hofstra University ('06), Dr. Vaccaro went on to earn his Ph.D. in aeronautical engineering in from Rensselaer Polytechnic Institute.

Left to right, top to bottom: Attaway lecturing on for-loops, students demonstrating the wind turbine data collection project, a student problem-solving in MATLAB at the chalkboard, the course text book, students working with Dr. It may seem at first that a biomedical engineering student would only need to know how to use MATLAB efficiently and that a computer systems engineer would only need to know programming concepts, but in engineering today, both skill sets are vital. Instead of using code vectorization techniques and the many powerful functions built into MATLAB, they rely on for-loops and other low-level constructs. Not only does this approach take longer, the resulting solutions are usually not optimized for performance. Each semester, about engineering students in all engineering disciplines learn how to work with variables, data structures, loops, conditionals, functions, input and output, and other programming concepts within MATLAB and how to use MATLAB efficiently to solve engineering problems. I had to give them a two-page, single-spaced handout on how to open the appropriate code editor and start typing, and it took an entire lecture to go through the basic setup steps. For a student new to programming, this is much easier and more motivating than the edit-compile-execute-debug cycle required by other languages. Instead of spending the first lecture talking about how to use the development environment, I can now cover assignment statements, variables, expressions, operators, precedence, and vectors. Students are also motivated when they can visualize results in new ways. I cover MATLAB plots early in the semester because using a for-loop to create plots and charts is much more interesting to the students than repeatedly printing a string. It consists of two one-hour lectures per week, each followed by an hour and a half in the computer lab. A one-hour informal discussion session at the end of the week offers more opportunities for students to ask questions. In the lectures, I repeat the process of talking for five to ten minutes, showing an example using MATLAB, and then giving the students a problem to work on. Following each lecture they work with MATLAB in the lab to solve more advanced problems, which gives them an opportunity to immediately apply the abstract concepts they just learned. Working in pairs or groups of three, students complete three projects during the course. More complex than the ones I give during the lab sessions, these projects are designed to give students an idea of how various engineering disciplines use MATLAB to solve real problems. I typically include one project from each College of Engineering department every semester. Recent projects have included image processing for quality control on turbine blades, detecting differences in images, fingerprint recognition, finite differences for heat transfer applications, and elastic scattering spectroscopy for cancer detection. Beyond Basic Programming Concepts MATLAB is so easy for the students to use and learn that I can cover all the basic programming concepts that we used to cover using other platforms plus a great deal of mathematics and basic problem-solving, including introductions to linear algebra, curve fitting, and statistical analysis. More recently, we set up a desktop wind turbine in a wind tunnel and used MATLAB to collect and analyze data, perform curve fitting, calculate the power generated, and run simulations. We plan, for example, to use it more extensively in the linear algebra and engineering mechanics classes. Teaching programming concepts with MATLAB has yielded several advantages that we envisioned and a few that we did not. For example, many students typically have trouble grasping the notion of nested loops. Students see exactly how nested loops work and why they work. Many are surprised that a concept that was at first difficult is now so simple to them. It is a common misconception among engineering faculty that teaching a computation course using MATLAB means forgoing the programming concepts. This is not true at all. We have shown at Boston University that you can impart programming skills, efficient coding, and basic problem solving, all within the user-friendly MATLAB environment. About the Author Dr. Attaway holds a B. Published - v

DOWNLOAD PDF FRESHMAN ENGINEERING PROBLEM SOLVING WITH MATLAB

Chapter 2 : - MATLAB for Engineers (5th Edition)

This course, originating at Arizona State University at the Polytechnic Campus, is intended to introduce freshman engineering students to problem solving using an m-file environment, such as MATLAB, LabVIEW MathScript, Octave, etc.

These types of questions draw upon a deep understanding of the real world and upon everyday experience, and it is the mindset these questions engender that motivates the reinventing of the standard Engineering Programming course found in some form at every engineering school in the country. Engineers are problem solvers and the only way to learn problem solving is to do it! Only a human can solve problems; the computer is a tool. Design problems are the heart of engineering and to solve them requires creativity, teamwork, and broad knowledge. The approach to solving an engineering problem should proceed in an orderly, stepwise fashion, but often problem solving is an iterative procedure. To become a good problem solver, an engineer must have: The ability to logically break a problem into pieces is most important. With all this in mind, a pilot course is now being taught that attempts to instill excitement and relevance into a course that, in our opinion, desperately needs revision. A course summary is shown below. Student evaluations for the course, as well as evaluations of how the course impacts courses in the sophomore and junior years where problem-solving skills and engineering tools are widely applied, are being conducted and will be reported.

Roche de Guzman obtained his Ph. His research interests are: Biomaterials and Mathematical Modeling. After graduating with a B. Vaccaro went on to earn his Ph. His area of research is in the field of experimental fluid mechanics and aerodynamics with a focus on wind tunnel testing. Specifically, he has collaborated with the Northrop Grumman Corporation researching the use of flow control in aggressive engine inlet ducts. There, he designed the fan and compressor sections of aircraft engines. He frequently returns to General Electric Aviation as a consultant.

Pesch was born and raised in northeastern Ohio. After graduating from Ohio University, he spent time in the jet engine overhaul industry before pursuing graduate studies at Cleveland State University. During his time studying at Cleveland State, he also taught undergraduate classes and participated in research at the Center for Rotating Machinery Dynamics and Control. Pesch is an assistant professor of engineering at Hofstra University. His duties include teaching undergraduate classes, engaging in scholarly research, and participation in the Hofstra University Robotics and Advanced Manufacturing Laboratory and Hofstra University Center for Innovation which grow the knowledge base of New York in the area of mechatronics in modern manufacturing and bridge the gap between university and industry development. He received the M. He worked in the mechanical-nuclear design department of a major engineering firm in NYC and taught and received tenure at both the U. Merchant Marine Academy and Hofstra University. From , as a tenured full professor of mechanical engineering at Rensselaer Polytechnic Institute, he developed the mechatronics teaching and research program focusing on human-centered, model-based design with a balance between theory and industry best practices. At Rensselaer, he graduated 37 M. In at RPI, he received the two highest awards conferred for teaching: Over the past 20 years, he has conducted hands-on, integrated, customized, mechatronics workshops for practicing engineers nationally and internationally, e. In the fall of , he returned to the Hofstra University School of Engineering and Applied Science as a tenured full professor of mechanical engineering. Are you a researcher? Would you like to cite this paper? Visit the ASEE document repository at peer.

Chapter 3 : Problem Solving with Excel and Matlab

The current freshman engineering computer programming course, which utilizes MATLAB programming language, is being experimentally redesigned to incorporate and highlight activities focused on engineering problem solving and system investigation processes.

Developing data literacy and problem solving in first year engineering students Dan Burlerson, College of Engineering, University of Houston Computation is fundamental. It is the basis for understanding and apply knowledge to real world problem. By emphasizing computation in a first year engineering course at the University of Houston, students are expose to how the mathematical fundamentals they have learned or are learning connect to solving engineering problems. MATLAB is used a medium for bridging the gap between mathematical fundamentals and application for students. It is vital that students early in their undergraduate education realize that the knowledge being obtained are tools that can be used in various environments. Knowledge does not live in a bubble of individual classes or contexts but should be used and adapted moving forward. Through exposure to basic computational skills through MATLAB, first year engineering student develop problem solving skills that are necessary for success in later classes and as a professional engineer. MATLAB is a tool used to problem solve and apply familiar computational concepts to unfamiliar contexts. In addition, computational skills help students begin thinking about process, not just the correct answer. It is in this first year of engineering that students are not given how to get from given values to the final result. Instead, by using computational skills with MATLAB, students begin to focus on the process and developing the logic and algorithm to get from the givens to the final result. The challenge is not longer getting the correct answer but how to develop a process to get the correct answer no matter the scenario. It is through that realize that students realize the power of computation and the power of programming tools like MATLAB. When I took over as coordinator for the freshman Computing and Problem Solving course, my goal was to emphasize basic computational concepts, how they apply to real world engineering problems, and use MATLAB as a tool to execute this knowledge. However, with freshman students in particular, I believe developing comfort with computation starts with an understanding of data. In particular, understanding the different kinds of data, where data can be found, and identifying quality data. While many of our students come into college with a working knowledge of literature references and writing papers, few have experienced the challenge of find useful data that can be use to better understand a larger topic. This was the motivation for developing a semester-long project. Centered around the National Academy Grand Challenges, students begin a journey that takes them through the process of identifying a challenge facing engineers today then search through public domains to find datasets that will allow for them to investigate and inform the public. Through various checkpoint during the semester, students develop goals for their computation, an algorithm, and a final code. Given the space to discover and apply the basic MATLAB skills they learn throughout the class, students have built confidence in their ability to tackle larger issues and use their foundational knowledge. In addition, as a final task, students are required to present their work in the form of a poster and video tutorial where they can develop communication skills and learn to receive critical feedback on their work. It is through the entire process that students become comfortable with computation through MATLAB without even realizing how far they have come. Downloadable version of this essay.

Chapter 4 : Developing data literacy and problem solving in first year engineering students

Connexions's blog.quintoapp.coman Engineering Problem Solving with MATLAB The objective of this course is that students can use an m- le scripting environment (MATLAB.) to solve freshman engineering problems.

Like similar courses at other universities, the content was always dictated by the needs of computer science majors. This one-size-fits-all approach failed to engage many engineering students because engineers and computer scientists approach programming with divergent goals. While engineers typically create programs that they will use themselves, computer scientists typically create programs for use by non-programmers. MATLAB provides a versatile system for solving problems, but it is also a dynamic programming language that can be used to learn and teach a full range of computer science concepts—from conditionals and variables to recursion and object-oriented programming. The ebook is used as a textbook for a course that develops MATLAB skills early in the engineering curriculum, making it possible to cover much more material in upper-level engineering courses that require MATLAB programming. At first, while many department heads acknowledged that MATLAB was the best language for practicing engineers and scientists, they were understandably skeptical that it would support the array of programming constructs taught in CS. Before they would allow their majors to move to a course based on MATLAB, they needed to be assured that MATLAB provided not only branching, looping, and function calling but also structures, recursion, and pointers—everything required for an introductory programming course. Most importantly, he promised the faculty that the new course would cover all the topics in CS. In January the school offered CS Introductory Programming for Engineers and Scientists, with a limit of 25 students. The 25 slots filled up immediately. When class started, 68 students were enrolled. The following year, there were A few years later, working with graduate student and teaching assistant John Crocetti, he expanded the supplementary material into a textbook. In subsequent years, the book was provided as a PDF document at the beginning of each semester. In , we seized an opportunity to write a new, updated textbook as an ebook, making it available to students with iPad devices. In addition to being more portable than a traditional textbook, an Apple ebook offers several other advantages. Second, animations and videos can be included, helping students understand abstract and complex subjects best illustrated with motion. The CS ebook has numerous videos, including one showing an animated surface plot and another showing the insertion of a new node in a linked list Figure 2. We were careful to provide consistent, accepted definitions for all computer science terms used in the course. When students encounter a new term in the ebook, with a single tap they can see a definition, jump to the glossary, or even switch to a browser and read more about the term on Wikipedia. Student annotations showing code selected for copying blue and text highlighted for later review green. Students can use this capability from their dorm room or anywhere else on campus, freeing them from having to visit a computer lab or carry their laptops around to experiment with new ideas. Following that simplified lesson, we tell the students it is time to begin some real programming, and we follow the topics covered in the ebook. After introducing the MATLAB environment, including matrices and operators, we teach procedural programming, beginning with a lesson on functions. Students learn the importance of well-defined interfaces and how to use functions to create reusable software components. We then take a more in-depth look at functions, introducing functions with a variable number of arguments and recursion. The final lessons cover searching, including sequential and binary searches, and sorting algorithms, including selection sort and merge sort. CS concludes with a project in which the students apply the concepts they have learned throughout the semester. Past projects have included processing and analyzing Twitter data in MATLAB and calculating the force needed to slingshot a rocket around Jupiter and out of the solar system, for example. CS Today CS is now a required course for first-year civil, chemical, mechanical, and biomedical engineering students at Vanderbilt. The course is also popular among science majors and other non-engineering students, and about a quarter of the more than students enrolled each semester take the course as an elective. In addition to its growing popularity among students, the

DOWNLOAD PDF FRESHMAN ENGINEERING PROBLEM SOLVING WITH MATLAB

course has garnered the approval of engineering faculty across departments. As for the ebook, it has been well received by the students. The examples started out simple and easy to understand and progressed to more challenging throughout each chapter. The commentary throughout was fun, and the functions at the back of the chapter really helped me practice the concepts. It was nice that half the solutions were easily accessible online. The graphics and images were also really great and easy to understand. Lastly, I appreciated the computer version of the textbook, which made it easy to carry around. Made my class much more enjoyable. In CS, that is no longer the case. They clearly enjoy the course and, as a result, work harder and learn more. About the Author Michael Fitzpatrick is a professor emeritus of computer science at Vanderbilt University. He retired in after teaching at the college level for 35 years, teaching computer science for 29 years, and teaching computer programming with MATLAB for 11 years. He received a B. He holds an M. His research includes model-integrated computing and wireless sensor networks. Published - v

Chapter 5 : ASEE PEER - Freshman Engineering Problem Solving with MATLAB for All Disciplines

Preface Introduction to MATLAB for Engineering Students" is a document for an introductory course in MATLAB®R 1 and technical computing. It is used for freshmen classes at North-.

Chapter 6 : Freshman Engineering Problem Solving with MATLAB - Download link

Over the years, CS Programming and Problem Solving has been taught using a variety of languages, including Fortran, Pascal, C, C++, and Java. In , in order to address the frustration engineering students were experiencing with CS , Vanderbilt's School of Engineering decided to offer an alternative based on MATLAB.

Chapter 7 : Using Matlab for Engineering Problem Solving

A Freshman Course in Electrical Engineering: Problem Solving with MATLAB / Edition 1 available in Paperback. A Freshman Course in Electrical Engineering: Problem.