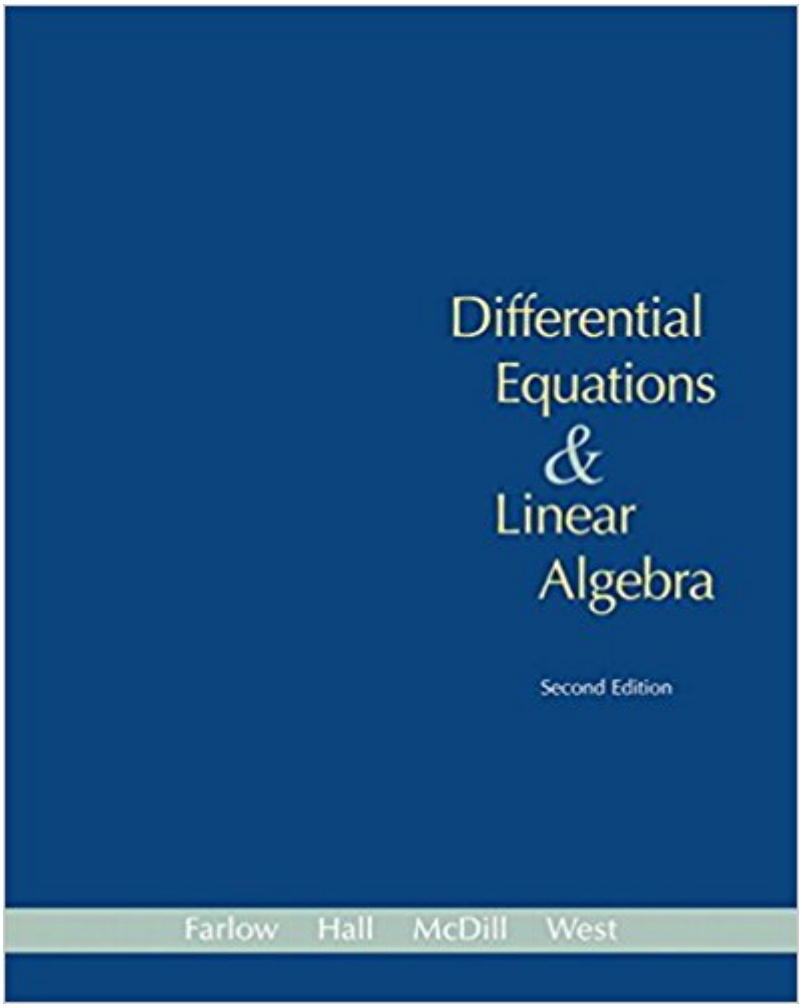
Differential Equations And Linear Algebra (2nd Edition)



Synopsis

For sophomore-level courses in Differential Equations and Linear Algebra. Â Extensively rewritten throughout, the Second Edition of thisÂ flexible text features a seamless integration of linear algebra into the discipline of differential equations. Abundant computer graphics, IDE interactive illustration software, and well-thought-out problem sets make it an excellent choice for either the combination DE/LA course or pure differential equations courses. The authorsâ ™ consistent, reader-friendly presentation encourages students to think both quantitatively and qualitatively when approaching differential equations â ”Â and reinforces concepts using similar methods to solve various systems (algebraic, differential, and iterative).

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Customer Reviews

FEATURES High integration of illustrations and figures helps students visualize concepts. Computer graphics analysis approach provides students with a real understanding of nonlinear differential equations. Balanced qualitative and quantitative analysis helps students interact with the equations. Careful integration of linear algebra emphasizes the inter-relatedness of differential equations and linear algebra while helping students to analyze the physical systems being modeled. STUDENT SUPPLEMENTS Prentice Hall Companion Website www.prenhall.com/farlow This FREE Companion Website offers interactive modules in JAVA applets, T/F Quizzes, Live Examples, Links, and a customizable syllabus builder. Interactive Differential Equations CD-ROM – This text-specific interactive CD-ROM allows students to manipulate equations in a modular setting. It

focuses on helping students visualize ODE concepts and includes applications to engineering, physics, chemistry, and biology. It runs on Windows or Macintosh. --This text refers to an out of print or unavailable edition of this title.

This text is a response to departments of mathematics (many at engineering colleges) that have asked for a combined course in differential equations and linear algebra. It differs from other combined texts in its effort to stress the modern qualitative approach to differential equations, and to merge the disciplines more effectively. Differential Equations In recent years, the emphasis in differential equations has moved away from the study of closed-form transient solutions to the qualitative analysis of steady-state solutions. Concepts such as equilibrium points and stability are becoming the focus of attention, replacing phrases such as integrating factor and reduction of order, and diminishing concentration on formulas. In the past, students of differential equations were generally left with the impression that all differential equations could be "solved," and if given enough time and effort, closed-form expressions involving polynomials, exponentials, trigonometric functions, and so on could always be found. For students to be left with this impression is a mathematical felony inasmuch as even simple-looking equations such as dy/dt = y2 – t and dy/dt = cos(y – t) do not have closed-form solutions. But these equations do have solutions, which we can see graphically, in Figures 1 and 2. In the traditional differential equations course, students spent much of their time grinding out "cookbook" solutions to "cookbook" equations, and not gaining much intuition and real understanding for the solutions or the subject. Nowadays, with computers and software packages readily available for finding numerical solutions, plotting vector and directional fields, and carrying out physical simulations, the student can study differential equations on a more sophisticated level than former students, and ask questions not contemplated by students (or teachers) in the past. Key information is transmitted instantly by visual presentations, especially when students can watch solutions evolve. We use graphics heavily in the text and in the problem sets. Linear Algebra The visual approach is especially important in making the connections with linear algebra. Although differential equations have long been treated as one of the best applications of linear algebra, in traditional treatments students tended to miss key links. It’s a delight to hear those who have taken those old courses gasp with sudden insight when they see the role of eigenvectors and eigenvalues in phase portraits. Throughout the text we stick to the main theme from linear algebra that the general solution of a linear system is the solution to the associated homogeneous equation plus any particular solution. Consequently, for the first-order linear differential equation we solve the homogeneous equation by separation of variables, and then

find a particular solution by a first-order variation of parameters method. Of course, we solve the second-order linear equations and linear systems using the same strategy, giving a more systematic approach to solving linear differential equations, as well as showing how concepts in linear algebra play an important role in differential equations. Differences from Traditional Texts Although we have more pages explicitly devoted to differential equations than to linear algebra, we have tried to provide all the basics of both that either course syllabus would normally require. But merging two subjects into one (while at the same time enhancing the usual quantitative techniques with qualitative analysis of differential equations) requires streamlining and simplification. The result should serve students well in subsequent courses and applications. Some Techniques De-emphasized Many of the specialized techniques used to solve small classes of differential equations are no longer included within the confines of the text, but have been graciously retired to the problem set. The same is true for some of the specialized techniques of linear algebra. The customary chapter on Laplace transforms has been reduced to two sections covering the basics, but other useful items and extensions appear in the exercises. Dynamical Systems Philosophy We focus on the long-term behavior of a system as much as its transient behavior. Direction fields, phase plane analysis and trajectories of Solutions, equilibria, and stability are discussed whenever appropriate. Exploration Problems for nontraditional topics such as bifurcation and chaos often involve guided or open-ended exploration, rather than application of a formula to arrive at a specific numerical answer. Although this exercise is not traditional, it reflects the nature of how mathematics advances. This experimental stage is the world for which students are headed; it is essential that they learn how to do it, especially how to organize and communicate about the results. Problem Sets Each problem set involves most or all of the following: traditional problems for hand calculation (and understanding of techniques) additional traditional techniques graphical exercises (drawing, matching) to gain understanding of different representations real world applications some open-ended questions or exploration suggested journal entries (writing exercises) Technology More problems than inmost texts suggest or require "computer software," but let us emphasize that this suggestion refers to whatever resources are available to students. A CD-ROM Interactive Differential Equations (IDE) is provided with the book, with pointers throughout the text, to give students immediate visual access to concepts. IDE is a unique collection of 97 "tools" (interactive illustrations) that bring to life examples and ideas. Each has an easy and intuitive interface. Use of this CD is entirely optional, but students have found it very helpful, and instructors can use it for short demonstrations that immediately get a point across. However, IDE is not an "open-ended graphic DE solver," and therefore further access to technology is required—students must be

able to make their own pictures, with their own equations, to answer their own questions. We do not prescribe any specific software of this type, because students and departments usually already have familiarity with different systems that will serve this purpose. We do not want to add computing to the learning load of the students—we would far rather they devote their energy to the mathematics. All that is needed is an ability to draw direction fields and solutions for differential equations, an occasional algebraic curve, and simple spreadsheet capability. A graphing calculator is sufficient for most of these problems; a complete computer algebra system (CAS) such as Derive, Maple, Mathematica, or MATL,AB is more than adequate, but not at all necessary. Handiest for differential equations is dedicated software such as that provided at our website. Details are provided in the section "To the Reader". Writing in Mathematics In recent years, the "Writing Across the Curriculum" crusade has spread across American colleges and universities, with the idea of learning through writing. We include "Suggested Journal Entries" at the end of each problem set, asking the student to write something about the section. The topics suggested should be considered simply as possible ideas; students may come up with something different on their own that is more relevant to their own thinking and evolving understanding. Another way to ask students to keep a scholarly journal is to allow five minutes at the end of class for each student to write and outline what he or she does or does not understand. The goal is simply to encourage writing about mathematics; the degree to which it raises student understanding and performance is amazing! Further background is provided in the section "To the Reader". Historical Perspective We have tried to give the reader an appreciation of the richness and history of differential equations and linear algebra through footnotes and the use of "Historical Notes," which are included throughout the book. They can also be used by the instructor to foster discussions on the history of mathematics. Applications We include traditional applications of differential equations: mechanical vibrations, electrical circuits, biological problems, biological chaos, heat flow problems, compartmental problems, and many more. Many sections have applications at the end, where an instructor can choose to spend extra time. Furthermore, many problems introduce new applications and ideas not normally found in a beginning differential equations text (reversible systems, adjoint systems, Hamiltonians, . . .) for the more curious reader. The final two chapters introduce related subjects that suggest ideal follow-up courses. Discrete Dynamical Systems: Iterative or difference equations (both linear and nonlinear) have important similarities and differences from differential equations. The ideas are simple, but the results can be surprisingly complicated. Subsections are devoted to the discrete logistic equation and its path to chaos. Control Theory: Although one of the most important applications of differential equations is control theory, few books on differential equations

spend any time on the subject. This short chapter introduces a few of the important ideas, including feedback control and the Pontryagin maximum principle. Obviously you will not have time to look at every application; as four authors with different interests and specialties, we do not expect that. But we would suggest that you choose to spend some time on what is closest to your heart, and in addition become aware of ... --This text refers to an out of print or unavailable edition of this title.

This book is an awful textbook, the examples are the worst and at no point do they endeavor to thoroughly explain how to solve ODEs. This is more of a reference book for refreshing ones memory after already taking the course. I'm so angry that I had to spend 120 bucks on this book when I spent the entire semester using Paul's online math notes (for free) to learn how to do DEs.

This is not a suitable book for learning; period. I am a university student taking the Linear Algebra & Differential Equations and this book has not helped whatsoever, if anything it has made material more confusing. As I do not feel the need to attend every lecture, I am usually able to read the corresponding textbook to a course and learn the material myself. However, this cannot be done with this book as it does not express proof to conditions or rules; it will just spit out the steps with no proof or reasoning. I have now begun to attend lecture for this course and the professor seems to teach better by improvising material rather than obtain material from this textbook.

Needed this for class and it came as expected.

Informative and accurate

required for class

The content is okay. The authors could do a better job of explaining since they leave out some basic explanations.The condition was used but not very good. Actually it was beat to hell but still usable.

I was able to teach myself a lot with this book. I had to use other resources to fully understand the concepts, but the book had a lot of step-by-step examples which helped me a lot.

Shipped quickly and came as picted.

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