ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS pdf

1: Ordinary differential equation - Wikipedia

Ordinary and Partial Differential Equations by John W. Cain and Angela M. Reynolds Department of Mathematics & Applied Mathematics Virginia Commonwealth University.

I fell into the trap that many web developers fall into. I knew what was in the menus and so clearly all the users would as well It was appearing that many new users were not aware of the Practice Problems on the site so I added a set of links at the top to allow for easy switching between the Notes, Practice Problems and Assignment Problems. They will only appear on the class pages which have Practice and Assignment problems. The links should stay at the top as you scroll through the page. Paul November 7, Mobile Notice You appear to be on a device with a "narrow" screen width i. Due to the nature of the mathematics on this site it is best views in landscape mode. If your device is not in landscape mode many of the equations will run off the side of your device should be able to scroll to see them and some of the menu items will be cut off due to the narrow screen width. Differential Equations Here are my notes for my differential equations course that I teach here at Lamar University. Here are a couple of warnings to my students who may be here to get a copy of what happened on a day that you missed. Because I wanted to make this a fairly complete set of notes for anyone wanting to learn differential equations have included some material that I do not usually have time to cover in class and because this changes from semester to semester it is not noted here. In general, I try to work problems in class that are different from my notes. However, with Differential Equation many of the problems are difficult to make up on the spur of the moment and so in this class my class work will follow these notes fairly close as far as worked problems go. With that being said I will, on occasion, work problems off the top of my head when I can to provide more examples than just those in my notes. Sometimes questions in class will lead down paths that are not covered here. You should always talk to someone who was in class on the day you missed and compare these notes to their notes and see what the differences are. This is somewhat related to the previous three items, but is important enough to merit its own item. Using these notes as a substitute for class is liable to get you in trouble. As already noted not everything in these notes is covered in class and often material or insights not in these notes is covered in class. Here is a listing and brief description of the material that is in this set of notes. Basic Concepts - In this chapter we introduce many of the basic concepts and definitions that are encountered in a typical differential equations course. We will also take a look at direction fields and how they can be used to determine some of the behavior of solutions to differential equations. Definitions â€" In this section some of the common definitions and concepts in a differential equations course are introduced including order, linear vs. Direction Fields â€" In this section we discuss direction fields and how to sketch them. We also investigate how direction fields can be used to determine some information about the solution to a differential equation without actually having the solution. Final Thoughts â€" In this section we give a couple of final thoughts on what we will be looking at throughout this course. First Order Differential Equations - In this chapter we will look at several of the standard solution methods for first order differential equations including linear, separable, exact and Bernoulli differential equations. In addition we model some physical situations with first order differential equations. Linear Equations â€" In this section we solve linear first order differential equations, i. We give an in depth overview of the process used to solve this type of differential equation as well as a derivation of the formula needed for the integrating factor used in the solution process. Separable Equations â€" In this section we solve separable first order differential equations, i. We will give a derivation of the solution process to this type of differential equation. Exact Equations â€" In this section we will discuss identifying and solving exact differential equations. We will develop of a test that can be used to identify exact differential equations and give a detailed explanation of the solution process. We will also do a few more interval of validity problems here as well. Bernoulli Differential Equations â€" In this section we solve Bernoulli differential equations, i. This section will also introduce the idea of using a substitution to help us solve differential equations. Intervals of Validity â€" In this section we will give an in depth look at intervals of validity as well as an answer to the existence and uniqueness question for first order differential equations. Modeling with First Order Differential

Equations â€” In this section we will use first order differential equations to model physical situations. In particular we will look at mixing problems modeling the amount of a substance dissolved in a liquid and liquid both enters and exits , population problems modeling a population under a variety of situations in which the population can enter or exit and falling objects modeling the velocity of a falling object under the influence of both gravity and air resistance. We discuss classifying equilibrium solutions as asymptotically stable, unstable or semi-stable equilibrium solutions. Second Order Differential Equations - In this chapter we will start looking at second order differential equations. We will concentrate mostly on constant coefficient second order differential equations. We will derive the solutions for homogeneous differential equations and we will use the methods of undetermined coefficients and variation of parameters to solve non homogeneous differential equations. In addition, we will discuss reduction of order, fundamentals of sets of solutions, Wronskian and mechanical vibrations. We derive the characteristic polynomial and discuss how the Principle of Superposition is used to get the general solution. We will also derive from the complex roots the standard solution that is typically used in this case that will not involve complex numbers. We will use reduction of order to derive the second solution needed to get a general solution in this case. Reduction of Order â€” In this section we will discuss reduction of order, the process used to derive the solution to the repeated roots case for homogeneous linear second order differential equations, in greater detail. This will be one of the few times in this chapter that non-constant coefficient differential equation will be looked at. Fundamental Sets of Solutions â€” In this section we will a look at some of the theory behind the solution to second order differential equations. We define fundamental sets of solutions and discuss how they can be used to get a general solution to a homogeneous second order differential equation. We will also define the Wronskian and show how it can be used to determine if a pair of solutions are a fundamental set of solutions. More on the Wronskian â€” In this section we will examine how the Wronskian, introduced in the previous section, can be used to determine if two functions are linearly independent or linearly dependent. We will also give and an alternate method for finding the Wronskian. Nonhomogeneous Differential Equations â€” In this section we will discuss the basics of solving nonhomogeneous differential equations. We define the complimentary and particular solution and give the form of the general solution to a nonhomogeneous differential equation. Undetermined Coefficients â€” In this section we introduce the method of undetermined coefficients to find particular solutions to nonhomogeneous differential equation. We work a wide variety of examples illustrating the many guidelines for making the initial guess of the form of the particular solution that is needed for the method. Variation of Parameters â€” In this section we introduce the method of variation of parameters to find particular solutions to nonhomogeneous differential equation. We give a detailed examination of the method as well as derive a formula that can be used to find particular solutions. Mechanical Vibrations â€” In this section we will examine mechanical vibrations. In particular we will model an object connected to a spring and moving up and down. We also allow for the introduction of a damper to the system and for general external forces to act on the object. Note as well that while we example mechanical vibrations in this section a simple change of notation and corresponding change in what the quantities represent can move this into almost any other engineering field. We will solve differential equations that involve Heaviside and Dirac Delta functions. We will also give brief overview on using Laplace transforms to solve nonconstant coefficient differential equations. In addition, we will define the convolution integral and show how it can be used to take inverse transforms. The Definition â€” In this section we give the definition of the Laplace transform. We will also compute a couple Laplace transforms using the definition. Laplace Transforms â€” In this section we introduce the way we usually compute Laplace transforms that avoids needing to use the definition. We discuss the table of Laplace transforms used in this material and work a variety of examples illustrating the use of the table of Laplace transforms. Inverse Laplace Transforms â€” In this section we ask the opposite question from the previous section. In other words, given a Laplace transform, what function did we originally have? We again work a variety of examples illustrating how to use the table of Laplace transforms to do this as well as some of the manipulation of the given Laplace transform that is needed in order to use the table. Step Functions â€” In this section we introduce the step or Heaviside function. We illustrate how to write a piecewise function in terms of Heaviside functions. We also work a variety of examples showing how to take

Laplace transforms and inverse Laplace transforms that involve Heaviside functions. We also derive the formulas for taking the Laplace transform of functions which involve Heaviside functions. The examples in this section are restricted to differential equations that could be solved without using Laplace transform. The advantage of starting out with this type of differential equation is that the work tends to be not as involved and we can always check our answers if we wish to. We do not work a great many examples in this section. We only work a couple to illustrate how the process works with Laplace transforms. Without Laplace transforms solving these would involve quite a bit of work. While we do not work one of these examples without Laplace transforms we do show what would be involved if we did try to solve on of the examples without using Laplace transforms. We work a couple of examples of solving differential equations involving Dirac Delta functions and unlike problems with Heaviside functions our only real option for this kind of differential equation is to use Laplace transforms. We also give a nice relationship between Heaviside and Dirac Delta functions. Convolution Integral â€" In this section we giver a brief introduction to the convolution integral and how it can be used to take inverse Laplace transforms. We also illustrate its use in solving a differential equation in which the forcing function i. Systems of Differential Equations - In this chapter we will look at solving systems of differential equations. We will restrict ourselves to systems of two linear differential equations for the purposes of the discussion but many of the techniques will extend to larger systems of linear differential equations. In addition, we give brief discussions on using Laplace transforms to solve systems and some modeling that gives rise to systems of differential equations. Systems of Equations â€" In this section we will give a review of the traditional starting point for a linear algebra class. We will use linear algebra techniques to solve a system of equations as well as give a couple of useful facts about the number of solutions that a system of equations can have. Matrices and Vectors â€" In this section we will give a brief review of matrices and vectors. Eigenvalues and Eigenvectors â€" In this section we will introduce the concept of eigenvalues and eigenvectors of a matrix. We define the characteristic polynomial and show how it can be used to find the eigenvalues for a matrix. Once we have the eigenvalues for a matrix we also show how to find the corresponding eigenvalues for the matrix. Systems of Differential Equations â€" In this section we will look at some of the basics of systems of differential equations.

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2: Separation of variables - Wikipedia

Differential equations (DEs) come in many varieties. And different varieties of DEs can be solved using different methods. You can classify DEs as ordinary and partial Des. In addition to this distinction they can be further distinguished by their order. An ordinary differential equation (ODE) has.

A solution defined on all of R is called a global solution. A general solution of an nth-order equation is a solution containing n arbitrary independent constants of integration. A valuable but little-known work on the subject is that of Houtain Darboux starting in was a leader in the theory, and in the geometric interpretation of these solutions he opened a field worked by various writers, notable ones being Casorati and Cayley. To the latter is due the theory of singular solutions of differential equations of the first order as accepted circa Reduction to quadratures[edit] The primitive attempt in dealing with differential equations had in view a reduction to quadratures. As it had been the hope of eighteenth-century algebraists to find a method for solving the general equation of the nth degree, so it was the hope of analysts to find a general method for integrating any differential equation. Gauss showed, however, that the differential equation meets its limitations very soon unless complex numbers are introduced. Hence, analysts began to substitute the study of functions, thus opening a new and fertile field. Cauchy was the first to appreciate the importance of this view. Thereafter, the real question was to be not whether a solution is possible by means of known functions or their integrals but whether a given differential equation suffices for the definition of a function of the independent variable or variables, and, if so, what are the characteristic properties of this function. Collet was a prominent contributor beginning in , although his method for integrating a non-linear system was communicated to Bertrand in Clebsch attacked the theory along lines parallel to those followed in his theory of Abelian integrals. He showed that the integration theories of the older mathematicians can, by the introduction of what are now called Lie groups , be referred to a common source, and that ordinary differential equations that admit the same infinitesimal transformations present comparable difficulties of integration. He also emphasized the subject of transformations of contact. The theory has applications to both ordinary and partial differential equations. Symmetry methods have been recognized to study differential equations, arising in mathematics, physics, engineering, and many other disciplines. Sturmâ€”Liouville theory Sturmâ€”Liouville theory is a theory of a special type of second order linear ordinary differential equations. Their solutions are based on eigenvalues and corresponding eigenfunctions of linear operators defined in terms of second-order homogeneous linear equations. Liouville , who studied such problems in the mids. The interesting fact about regular SLPs is that they have an infinite number of eigenvalues, and the corresponding eigenfunctions form a complete, orthogonal set, which makes orthogonal expansions possible. This is a key idea in applied mathematics, physics, and engineering. Existence and uniqueness of solutions[edit] There are several theorems that establish existence and uniqueness of solutions to initial value problems involving ODEs both locally and globally. The two main theorems are Theorem.

3: Ordinary and Partial Differential Equations and Applications - Course

"Ordinary and Partial Differential Equations provides college-level readers with a comprehensive textbook covering both ordinary differential equations and partial differential equations, offering a complete course on both under one cover, which makes this a unique contribution to the field. Examples and exercises accompany software supporting.

4: Trefethen numerical ODE/PDE textbook

This course is a basic course offered to UG/PG students of Engineering/Science background. It contains existence and uniqueness of solutions of an ODE, homogeneous and non-homogeneous linear systems of differential equations, power series solution of second order homogeneous differential equations.

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5: Ordinary and Partial Differential Equations

Ordinary and partial differential equations: Fourier series, boundary and initial value problems. Prereq: , xx, , H, H, xx, xx, H.

6: Randy LeVeque -- Finite Difference Methods for ODEs and PDEs

Partial differential equations are differential equations that contain functions with multiple variables and their partial derivatives, while ordinary differential equations are differential equation that contain functions with just one variable and their derivatives.

7: M.D. Raisinghania (Author of Ordinary and Partial Differential Equations)

Part of the "Pitman Research Notes in Mathematics" series, this text presents the proceedings of the 12th Dundee Conference on Ordinary and Partial Differential Equations.

8: Differential Equations

A Course in Ordinary and Partial Differential Equations discusses ordinary differential equations and partial differential equations. The book reviews the solution of elementary first-order differential equations, existence theorems, singular solutions, and linear equations of arbitrary order.

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The Fair Maid of the West Reel 195. Haley-Hall, J. Piano someone like you adele sheet The warranty of title Fancy Nancy at the museum Mrs. Hemans female instructor, or, Young womans companion Anxiety disorders Carl Weems and Wendy Silverman Hp vertica essentials Master and the slave Colour centres and imperfections in insulators and semiconductors Governmental Attitudes Toward Urban Growth in the Dallas-Fort Worth, Texas Area A female style of reading? Two centuries of political change, by R. M. MacIver. The musical microcomputer Conversations with Lukcs Top-Tones for the Saxophone Statistical analysis of data James C. Boyd Friendship Making Life Better Acer aspire 5000 service manual Mediation, investigation, and arbitration in industrial disputes One Lucky Bastard Writing in the color of the stars Mazes for the Mind Within mem/returning forward Love and Hate in the Analytic Setting Documentary vs reality Essentials of marketing management marshall Lao Peoples Democratic Republic Promoting community health through innovative hospital-based programs Wombat who talked to the stars The thought culture of the English Renaissance Harvest of Dreams Paul Bids Us Sit And Then To Walk His masters voice 19.3 Revisiting Computerization 13 Her America 73 The Broken Triangle Against the death penalty An Act to Declare Certain Federal Lands Acquired for the Benefit of Indians to be Held in Trust for the T The Tale of Jemima Puddle-duck and Other Farmyard Tales