$$\frac{d^2y}{dx^2} + 3\frac{d^2y}{dx^2} - 4y = xe^x$$

$$\frac{d^2y}{dx^2} + 3\frac{d^2y}{dx^2} - 4y = 0$$

$$y = u = c_1 e^x + c_2 e^{-2x} + c_3 xe^{-2x}$$

differentiate to get $\quad \dfrac{d^3y}{dx^3} + 3\dfrac{d^2y}{dx^2} - 4\dfrac{dy}{dx} = xe^x + e^x$

subtract to get $\quad \dfrac{d^3y}{dx^3} + 2\dfrac{d^2y}{dx^2} - 3\dfrac{d^2y}{dx^2} - 4\dfrac{dy}{dx} + 4y = e^x$

differentiate to get $\quad \dfrac{d^4y}{dx^4} + 2\dfrac{d^3y}{dx^3} - 3\dfrac{d^3y}{dx^3} - 4\dfrac{d^2y}{dx^2} + 4\dfrac{dy}{dx} = e^x$

subtract to get $\quad \dfrac{d^5y}{dy^5} + \dfrac{d^4y}{dx^4} - 5\dfrac{d^3y}{dx^3} - \dfrac{d^2y}{dx^2} + 8\dfrac{dy}{dx} - 4y = 0$

let $y = e^{rx}$, so $r^5 + r^4 - 5r^3 - r^2 + 8r - 4 = 0$

$(r-1)(r+2)(r+2)(r-1)(r-1) = 0$

so, $y = u + v = c_1 e^x + c_2 e^{-2x} + c_3 xe^{-2x} + c_4 xe^x + c_5 x^2 e^x$

$$y = v = e^x\left(c_4 x + c_5 x^2\right)$$

differentiate to get $\quad \dfrac{dy}{dx} = e^x\left(c_4 + (c_4 + 2c_5)x + c_5 x^2\right)$

$$\frac{d^2y}{dx^2} = e^x\left(2(c_4 + c_5) + (c_4 + 4c_5)x + c_5 x^2\right)$$

$$\frac{d^2y}{dx^2} = e^x\left(3c_4 + 6c_5 + (c_4 + 6c_5)x + c_5 x^2\right)$$

$$9c_4 + 12c_5 + 18c_5 x = x$$

equate coefficients of like terms to get
$$9c_4 + 12c_5 = 0 \quad \text{and} \quad 18c_5 = 1$$

so, $c_5 = \dfrac{1}{18}$, $c_4 = -\dfrac{2}{27}$

COMPLETE SOLUTION:

$$y = u + v = c_1 e^x + c_2 e^{-2x} + c_3 xe^{-2x} - \frac{2}{27}xe^x + \frac{1}{18}x^2 e^x$$

Difference And Differential Equations

Walter G. Kelley,Allan C. Peterson

Difference And Differential Equations:

   An Introduction to Differential Equations, with Difference Equations, Fourier Series and Partial Differential Equations N. Finizio,G. E. Ladas,1982   Differential-Difference Equations Bellman,1963-01-01 Differential Difference Equations   *Difference and Differential Equations with Applications in Queueing Theory* Aliakbar Montazer Haghighi,Dimitar P. Mishev,2013-05-28 A Useful Guide to the Interrelated Areas of Differential Equations Difference Equations and Queueing Models Difference and Differential Equations with Applications in Queueing Theory presents the unique connections between the methods and applications of differential equations difference equations and Markovian queues Featuring a comprehensive collection of topics that are used in stochastic processes particularly in queueing theory the book thoroughly discusses the relationship to systems of linear differential difference equations The book demonstrates the applicability that queueing theory has in a variety of fields including telecommunications traffic engineering computing and the design of factories shops offices and hospitals Along with the needed prerequisite fundamentals in probability statistics and Laplace transform Difference and Differential Equations with Applications in Queueing Theory provides A discussion on splitting delayed service and delayed feedback for single server multiple server parallel and series queue models Applications in queue models whose solutions require differential difference equations and generating function methods Exercises at the end of each chapter along with select answers The book is an excellent resource for researchers and practitioners in applied mathematics operations research engineering and industrial engineering as well as a useful text for upper undergraduate and graduate level courses in applied mathematics differential and difference equations queueing theory probability and stochastic processes   *An Introduction to Difference Equations* Saber Elaydi,2005-12-15 In contemplating the third edition I have had multiple objectives to achieve The rst and foremost important objective is to maintain the cessibility and readability of the book to a broad readership with varying mathematical backgrounds and sophistication More proofs more graphs more explanations and more applications are provided in this edition The second objective is to update the contents of the book so that the reader stays abreast of new developments in this vital area of mathematics Recent results on local and global stability of one dimensional maps are included in Chapters 1 4 and Appendices A and C An extension of the Hartman Grobman Theorem to noninvertible maps is stated in Appendix D A whole new section on various notions of the asymptoticity of solutions and a recent extension of Perron s Second Theorem are added to Chapter 8 In Appendix E a detailed proof of the Levin May Theorem is presented In Chapters 4 and 5 the reader will nd the latest results on the larval pupal adult our beetle model The third and nal objective is to better serve the broad readership of this book by including most but certainly not all of the research areas in di erence equations As more work is being published in the Journal of Di erence Equations and Applications and elsewhere it became apparent that a whole chapter needed to be dedicated to this enterprise With the prodding and encouragement of Gerry Ladas the new Chapter 5

was born **Difference Equations from Differential Equations** Wilbert J. Lick,2012-12-06 In computational mechanics the first and quite often the most difficult part of a problem is the correct formulation of the problem This is usually done in terms of differential equations Once this formulation is accomplished the translation of the governing differential equations into accurate stable and physically realistic difference equations can be a formidable task By comparison the numerical evaluation of these difference equations in order to obtain a solution is usually much simpler The present notes are primarily concerned with the second task that of deriving accurate stable and physically realistic difference equations from the governing differential equations Procedures for the numerical evaluation of these difference equations are also presented In later applications the physical formulation of the problem and the properties of the numerical solution especially as they are related to the numerical approximations inherent in the solution are discussed There are numerous ways to form difference equations from differential equations *Differential and Difference Equations* Louis Brand,1966 **Difference Equations, Second Edition** R Mickens,1991-01-01 In recent years the study of difference equations has acquired a new significance due in large part to their use in the formulation and analysis of discrete time systems the numerical integration of differential equations by finite difference schemes and the study of deterministic chaos The second edition of Difference Equations Theory and Applications provides a thorough listing of all major theorems along with proofs The text treats the case of first order difference equations in detail using both analytical and geometrical methods Both ordinary and partial difference equations are considered along with a variety of special nonlinear forms for which exact solutions can be determined Numerous worked examples and problems allow readers to fully understand the material in the text They also give possible generalization of the theorems and application models The text s expanded coverage of application helps readers appreciate the benefits of using difference equations in the modeling and analysis of realistic problems from a broad range of fields The second edition presents analyzes and discusses a large number of applications from the mathematical biological physical and social sciences Discussions on perturbation methods and difference equation models of differential equation models of differential equations represent contributions by the author to the research literature Reference to original literature show how the elementary models of the book can be extended to more realistic situations Difference Equations Second Edition gives readers a background in discrete mathematics that many workers in science oriented industries need as part of their general scientific knowledge With its minimal mathematical background requirements of general algebra and calculus this unique volume will be used extensively by students and professional in science and technology in areas such as applied mathematics control theory population science economics and electronic circuits especially discrete signal processing

Difference Equations Walter G. Kelley,Allan C. Peterson,2001 Difference Equations Second Edition presents a practical introduction to this important field of solutions for engineering and the physical sciences Topic coverage includes numerical analysis numerical methods differential equations combinatorics and discrete modeling A hallmark of this revision is the

diverse application to many subfields of mathematics Phase plane analysis for systems of two linear equations Use of equations of variation to approximate solutions Fundamental matrices and Floquet theory for periodic systems LaSalle invariance theorem Additional applications secant line method Bison problem juvenile adult population model probability theory Appendix on the use of Mathematica for analyzing difference equaitons Exponential generating functions Many new examples and exercises   Differential Equations, Difference Equations and Matrix Theory Peter D. Lax,1957

Introduction to Difference Equations Samuel Goldberg,1958   *Nonstandard Finite Difference Models Of Differential Equations* Ronald E Mickens,1993-12-23 This book provides a clear summary of the work of the author on the construction of nonstandard finite difference schemes for the numerical integration of differential equations The major thrust of the book is to show that discrete models of differential equations exist such that the elementary types of numerical instabilities do not occur A consequence of this result is that in general bigger step sizes can often be used in actual calculations and or finite difference schemes can be constructed that are conditionally stable in many instances whereas in using standard techniques no such schemes exist The theoretical basis of this work is centered on the concepts of exact and best finite difference schemes In addition a set of rules is given for the discrete modeling of derivatives and nonlinear expressions that occur in differential equations These rules often lead to a unique nonstandard finite difference model for a given differential equation

Difference and Differential Equations Saber Elaydi,2004 Contains papers from the 7th International Conference on Difference Equations held at Hunan University Changsa China a satellite conference of ICM2002 Beijing This book includes articles that cover stability chaos symmetries boundary value problems and bifurcations for discrete dynamical systems and difference differential equations   **Differential and Difference Equations** Leonard C. Maximon,2018-04-22 This book intended for researchers and graduate students in physics applied mathematics and engineering presents a detailed comparison of the important methods of solution for linear differential and difference equations variation of constants reduction of order Laplace transforms and generating functions bringing out the similarities as well as the significant differences in the respective analyses Equations of arbitrary order are studied followed by a detailed analysis for equations of first and second order Equations with polynomial coefficients are considered and explicit solutions for equations with linear coefficients are given showing significant differences in the functional form of solutions of differential equations from those of difference equations An alternative method of solution involving transformation of both the dependent and independent variables is given for both differential and difference equations A comprehensive detailed treatment of Green s functions and the associated initial and boundary conditions is presented for differential and difference equations of both arbitrary and second order A dictionary of difference equations with polynomial coefficients provides a unique compilation of second order difference equations obeyed by the special functions of mathematical physics Appendices augmenting the text include in particular a proof of Cramer s rule a detailed consideration of the role of the superposition principal in the Green s function

and a derivation of the inverse of Laplace transforms and generating functions of particular use in the solution of second order linear differential and difference equations with linear coefficients   Finite Difference Methods for Ordinary and Partial Differential Equations Randall J. LeVeque,2007-09-06 Introductory textbook from which students can approach more advance topics relating to finite difference methods   **Difference Equations by Differential Equation Methods** Peter E. Hydon,2014-08-07 Straightforward introduction for non specialists and experts alike Explains how to derive solutions first integrals and conservation laws of difference equations   **Difference Equations by Differential Equation Methods** Peter Ellsworth Hydon,2014 Most well known solution techniques for differential equations exploit symmetry in some form Systematic methods have been developed for finding and using symmetries first integrals and conservation laws of a given differential equation This book explains how to extend these powerful methods to difference equations greatly increasing the range of solvable problems Beginning with an introduction to elementary solution methods the book gives readers a clear explanation of exact techniques for ordinary and partial difference equations The author uses worked examples to help readers grasp new concepts easily There are 120 exercises of varying difficulty and suggestions for further reading   Difference Equations and Inequalities Ravi P. Agarwal,2000-01-27 A study of difference equations and inequalities This second edition offers real world examples and uses of difference equations in probability theory queuing and statistical problems stochastic time series combinatorial analysis number theory geometry electrical networks quanta in radiation genetics economics psychology sociology and   **Difference Equations and Their Applications** A.N. Sharkovsky,Y. L. Maistrenko,E.Yu Romanenko,1993-03-31 The theory of difference equations is now enjoying a period of Renaissance Witness the large number of papers in which problems having at first sight no common features are reduced to the investigation of subsequent iterations of the maps f IR m IR m m 0 or which is in fact the same to difference equations The world of difference equations which has been almost hidden up to now begins to open in all its richness Those experts who usually use differential equations and in fact believe in their universality are now discovering a completely new approach which re sembles the theory of ordinary differential equations only slightly Difference equations which reflect one of the essential properties of the real world its discreteness rightful ly occupy a worthy place in mathematics and its applications The aim of the present book is to acquaint the reader with some recently discovered and at first sight unusual properties of solutions for nonlinear difference equations These properties enable us to use difference equations in order to model complicated os cillating processes this can often be done in those cases when it is difficult to apply ordinary differential equations Difference equations are also a useful tool of syn ergetics an emerging science concerned with the study of ordered structures The application of these equations opens up new approaches in solving one of the central problems of modern science the problem of turbulence   Oscillation Theory for Difference and Functional Differential Equations R.P. Agarwal,Said R. Grace,Donal O'Regan,2013-06-29 This monograph is devoted to a rapidly developing area of research of the qualitative

theory of difference and functional differential equations In fact in the last 25 years Oscillation Theory of difference and functional differential equations has attracted many researchers This has resulted in hundreds of research papers in every major mathematical journal and several books In the first chapter of this monograph we address oscillation of solutions to difference equations of various types Here we also offer several new fundamental concepts such as oscillation around a point oscillation around a sequence regular oscillation periodic oscillation point wise oscillation of several orthogonal polynomials global oscillation of sequences of real valued functions oscillation in ordered sets R oscillate oscillation in linear spaces oscillation in Archimedean spaces and oscillation across a family These concepts are explained through examples and supported by interesting results In the second chapter we present recent results pertaining to the oscil lation of n th order functional differential equations with deviating argu ments and functional differential equations of neutral type We mainly deal with integral criteria for oscillation While several results of this chapter were originally formulated for more complicated and or more general differ ential equations we discuss here a simplified version to elucidate the main ideas of the oscillation theory of functional differential equations Further from a large number of theorems presented in this chapter we have selected the proofs of only those results which we thought would best illustrate the various strategies and ideas involved

Difference Equations to Differential Equations Dan Slaughter,2009-09-24 This book by Dan Sloughter covers the following topics Sequences limits and difference equations functions and their properties best affine approximations integration polynomial approximations and Taylor series transcendental functions the complex plane differential equations The book is available in sections at http synechism org drupal de2de Answers for selected problems and related applets are also available at the site

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