

EXAMPLE:

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

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

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

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

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

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

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

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

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

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

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

differentiate to get $\frac{dy}{dx} = e^x (c_4 + (c_4 + 2c_5)x + c_5 x^2)$

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

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

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

equate coefficients of like terms to get

$$9c_4 + 12c_5 = 0 \text{ and } 18c_5 = 1$$

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

COMPLETE SOLUTION:

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

Computational Techniques For Ordinary Differential Equations

Peter Deuflhard, Folkmar Bornemann



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Computational Techniques for Differential Equations J. Noye, 2000-04-01 Computational Techniques for Differential Equations **Computational Methods in Ordinary Differential Equations** Jack D. Lambert, 1974 **Numerical Methods for Ordinary Differential Systems** J. D. Lambert, 1991 Numerical Methods for Ordinary Differential Systems The Initial Value Problem J D Lambert Professor of Numerical Analysis University of Dundee Scotland In 1973 the author published a book entitled Computational Methods in Ordinary Differential Equations Since then there have been many new developments in this subject and the emphasis has changed substantially This book reflects these changes it is intended not as a revision of the earlier work but as a complete replacement for it Although some basic material appears in both books the treatment given here is generally different and there is very little overlap In 1973 there were many methods competing for attention but more recently there has been increasing emphasis on just a few classes of methods for which sophisticated implementations now exist This book places much more emphasis on such implementations and on the important topic of stiffness than did its predecessor Also included are accounts of the structure of variable step variable order methods the Butcher and the Albrecht theories for Runge Kutta methods order stars and nonlinear stability theory The author has taken a middle road between analytical rigour and a purely computational approach key results being stated as theorems but proofs being provided only where they aid the reader's understanding of the result Numerous exercises from the straightforward to the demanding are included in the text This book will appeal to advanced students and teachers of numerical analysis and to users of numerical methods who wish to understand how algorithms for ordinary differential systems work and on occasion fail to work *Computational Methods in Ordinary Differential Equations* Jack D. Lambert, 1977 *Computational Techniques for Ordinary Differential Equations* Gladwell, I, D. K Sayers, 1980 **Numerical Methods for Differential Equations** J.R. Dormand, 2018-05-04 With emphasis on modern techniques Numerical Methods for Differential Equations A Computational Approach covers the development and application of methods for the numerical solution of ordinary differential equations Some of the methods are extended to cover partial differential equations All techniques covered in the text are on a program disk included with the book and are written in Fortran 90 These programs are ideal for students researchers and practitioners because they allow for straightforward application of the numerical methods described in the text The code is easily modified to solve new systems of equations Numerical Methods for Differential Equations A Computational Approach also contains a reliable and inexpensive global error code for those interested in global error estimation This is a valuable text for students who will find the derivations of the numerical methods extremely helpful and the programs themselves easy to use It is also an excellent reference and source of software for researchers and

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Computational Differential Equations Kenneth Eriksson, 1996-09-05 This textbook on computational mathematics is based on a fusion of mathematical analysis numerical computation and applications

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