

Differential quadrature method (DQM) for a class of singular two-point boundary value problems

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Differential quadrature method is applied in this work to solve singular two-point boundary value problems with a linear or non-linear nature. It is demonstrated through numerical examples that accurate results for the problem with different types of boundary conditions can be obtained using a considerably small number of grid points. The relative, root mean square and maximum absolute errors in computed solutions are given to show the performance of the method.

Keywords: singular boundary value problem; differential quadrature method; RMS error

AMS Subject Classification: 65L10

C.R. Category: G.1.7

1. Introduction

We consider the class of singular two-point boundary value problems arising quite often in applied mathematics,

$$(p(x)y')' = p(x)f(x, y), \quad 0 < x \leq 1, \quad (1)$$

with the boundary conditions

$$y(0) = A, \quad \alpha y(1) + \beta y'(1) = B, \quad (2)$$

or

$$y'(0) = 0, \quad \alpha y(1) + \beta y'(1) = B, \quad (3)$$

where $\alpha > 0$, $\beta \geq 0$, and A , B finite constants. The following conditions have been imposed on the function $p(x)$:

- $p(x) > 0$ on $(0, 1]$,
- $p(x) > 0 \in C^1(0, 1]$,
- $p(x) = x^{\alpha}g(x)$ on $[0, 1]$ and for some $r > 1$, $1/g(x)$ is analytic in $\{z : |z| < r\}$.

Further, it is assumed that the following conditions on the function $f(x, y)$ have been satisfied:

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Differential Quadrature Method Dqm Ppt Dl Hieng

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Differential Quadrature and Differential Quadrature Based Element Methods Xinwei Wang, 2015-03-24 Differential Quadrature and Differential Quadrature Based Element Methods Theory and Applications is a comprehensive guide to these methods and their various applications in recent years Due to the attractive features of rapid convergence high accuracy and computational efficiency the differential quadrature method and its based element methods are increasingly being used to study problems in the area of structural mechanics such as static buckling and vibration problems of composite structures and functional material structures This book covers new developments and their applications in detail with accompanying FORTRAN and MATLAB programs to help you overcome difficult programming challenges It summarises the variety of different quadrature formulations that can be found by varying the degree of polynomials the treatment of boundary conditions and employing regular or irregular grid points to help you choose the correct method for solving practical problems Offers a clear explanation of both the theory and many applications of DQM to structural analyses Discusses and illustrates reliable ways to apply multiple boundary conditions and develop reliable grid distributions Supported by FORTRAN and MATLAB programs including subroutines to compute grid distributions and weighting coefficients

Differential Quadrature and Its Application in Engineering Chang Shu, 2000-01-14 In the past few years the differential quadrature method has been applied extensively in engineering This book aimed primarily at practising engineers scientists and graduate students gives a systematic description of the mathematical fundamentals of differential quadrature and its detailed implementation in solving Helmholtz problems and problems of flow structure and vibration Differential quadrature provides a global approach to numerical discretization which approximates the derivatives by a linear weighted sum of all the functional values in the whole domain Following the analysis of function approximation and the analysis of a linear vector space it is shown in the book that the weighting coefficients of the polynomial based Fourier expansion based and exponential based differential quadrature methods can be computed explicitly It is also demonstrated that the polynomial based differential quadrature method is equivalent to the highest order finite difference scheme Furthermore the relationship between differential quadrature and conventional spectral collocation is analysed The book contains material on Linear Vector Space Analysis and the Approximation of a Function Polynomial Fourier Expansion and Exponential based Differential Quadrature Differential Quadrature Weighting Coefficient Matrices Solution of Differential Quadrature resultant Equations The Solution of Incompressible Navier Stokes and Helmholtz Equations Structural and Vibrational Analysis Applications Generalized Integral Quadrature and its Application in the Solution of Boundary Layer Equations Three FORTRAN programs for simulation of driven cavity flow vibration analysis of plate and Helmholtz eigenvalue problems respectively are appended These sample programs should give the reader a better understanding of differential quadrature and can easily be modified to solve the readers own engineering problems

Advanced Differential Quadrature

Methods Zhi Zong, Yingyan Zhang, 2009-01-20 Modern Tools to Perform Numerical Differentiation The original direct differential quadrature DQ method has been known to fail for problems with strong nonlinearity and material discontinuity as well as for problems involving singularity irregularity and multiple scales But now researchers in applied mathematics computational mechanics and en *DIFFERENTIAL QUADRATURE METHOD FOR TIME-DEPENDENT DIFFUSION EQUATION.* , 2003 This thesis presents the Differential Quadrature Method DQM for solving time dependent or heat conduction problem DQM discretizes the space derivatives giving a system of ordinary differential equations with respect to time and the fourth order Runge Kutta Method RKM is employed for solving this system Stabilities of the ordinary differential equations system and RKM are considered and step sizes are arranged accordingly The procedure is applied to several time dependent diffusion problems and the solutions are presented in terms of graphics comparing with the exact solutions This method exhibits high accuracy and efficiency comparing to the other numerical methods

Reviewing **Differential Quadrature Method Dqm Ppt Dl Hieng**: Unlocking the Spellbinding Force of Linguistics

In a fast-paced world fueled by information and interconnectivity, the spellbinding force of linguistics has acquired newfound prominence. Its capacity to evoke emotions, stimulate contemplation, and stimulate metamorphosis is actually astonishing. Within the pages of "**Differential Quadrature Method Dqm Ppt Dl Hieng**," an enthralling opus penned by a highly acclaimed wordsmith, readers set about an immersive expedition to unravel the intricate significance of language and its indelible imprint on our lives. Throughout this assessment, we shall delve in to the book is central motifs, appraise its distinctive narrative style, and gauge its overarching influence on the minds of its readers.

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