

# A COMPENDIUM OF PARTIAL DIFFERENTIAL EQUATIONS

## *METHOD OF LINE ANALYSIS WITH MATLAB*

William E. Schiesser, Graham W. Griffiths

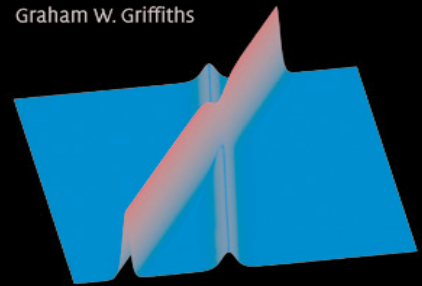
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*A Compendium of Partial Differential Equation Models* presents numerical methods and associated computer codes in Matlab for the solution of a spectrum of models expressed as partial differential equations (PDEs), one of the mostly widely used forms of mathematics in science and engineering. The authors focus on the method of lines (MOL), a well-established numerical procedure for all major classes of PDEs in which the boundary value partial derivatives are approximated algebraically by finite differences. This reduces the PDEs to ordinary differential equations (ODEs) and thus makes the computer code easy to understand, implement, and modify. Also, the ODEs (via MOL) can be combined with any other ODEs that are part of the model (so that MOL naturally accommodates ODE/PDE models). This book uniquely includes a detailed line-by-line discussion of computer code as related to the associated equations of the PDE model.

### **A Compendium of Partial Differential Equation Models**

**Method of Lines Analysis with Matlab**

William E. Schiesser  
Graham W. Griffiths



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## Key Features

- Includes line-by-line analysis and solutions for computer code associated with model equations
- Offers a detailed presentation of ODE/PDE mathematical models
- Methodology covers a broad spectrum of problems in science, engineering and applied mathematics

## Contents

1. An introduction to the Method of Lines (MOL); 2. A one-dimensional, linear partial differential equation; 3. Green's function analysis; 4. Two nonlinear, variable coefficient, inhomogeneous PDEs; 5. Euler, Navier-Stokes and Burgers equations; 6. The Cubic Schrödinger Equation (CSE); 7. The Korteweg-deVries (KdV) equation; 8. The linear wave equation; 9. Maxwell's equations; 10. Elliptic PDEs: Laplace's equation; 11. Three-dimensional PDE; 12. PDE with a mixed partial derivative; 13. Simultaneous, nonlinear, 2D PDEs in cylindrical coordinates; 14. Diffusion equation in spherical coordinates; Appendix 1: partial differential equations from conservation principles: the anisotropic diffusion equation; Appendix 2: order conditions for finite difference approximations; Appendix 3: analytical solution of nonlinear, traveling wave partial differential equations; Appendix 4: implementation of time varying boundary conditions; Appendix 5: the DSS library; Appendix 6: animating simulation results.

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