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Nodal discontinuous Galerkin methods. Algorithms, analysis, and applications.

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EUR 46.95/net; SFR 82.00; \$ 59.95; £ 36.00 (2008).

This book is intended to offer a comprehensive introduction to, and an efficient implementation of discontinuous Galerkin finite element methods for approximating solutions to partial differential equations.

The book consists of ten chapters. The first chapter contains a brief description of the book and a short history of the discontinuous Galerkin method. Chapter 2 presents the basics of the discontinuous Galerkin finite element method and is focussed on the formulation of this method for linear one-dimensional wave problems. This presentation is continued in Chapter 3 where several choices of the local basis are discussed. Chapter 4 is concerned with fundamental properties of the discontinuous Galerkin method such as stability and accuracy. Although the discussion in this chapter is focussed on one-dimensional linear problems, most of those results can easily be adapted to multidimensional or even to nonlinear problems. Chapter 5 deals with problems with variable coefficients and nonlinear conservation laws. Chapter 6 contains an extension to two-dimensional problems and Chapter 7 is concerned with equations of higher-order in the spatial variable. Chapter 8 is devoted to spectral properties of discontinuous Galerkin operators. Chapter 9 deals with curvilinear elements and nonconforming discretizations. Chapter 10 discusses the implementation of the method to three-dimensional problems.

Each chapter of the book is largely self-contained and is complemented by adequate exercises. The topics are illustrated by various examples, algorithms and Matlab codes for classical systems of partial differential equations including Poisson and Helmholtz equations, Maxwell's equation, Euler equation of gas dynamics, compressible and incompressible Navier-Stokes equations.

The book concludes with three appendices containing an overview of orthogonal polynomials and associated library routines, a brief introduction to grid generation, and some useful scripts and associated software. The style of writing is clear and concise, as are the illustrative examples taken from various branches of science and engineering. The book under review is an exceptionally complete and accessible reference for graduate students, researchers, and professionals in applied mathematics, physics, and engineering. It may be used in graduate-level courses, as a self-study resource, or as a research reference.

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