Numerical methods for evolutionary differential equations

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Abstrak

This textbook develops, analyzes, and applies numerical methods for evolutionary, or time-dependent, differential problems. Both PDEs and ODEs are discussed from a unified viewpoint. The author emphasizes finite difference and finite volume methods, specifically their principled derivation, stability, accuracy, efficient implementation, and practical performance in various fields of science and engineering. Smooth and nonsmooth solutions for hyperbolic PDEs, parabolic-type PDEs, and initial value ODEs are treated, and a practical introduction to geometric integration methods is included as well.
The author bridges theory and practice by developing algorithms, concepts, and analysis from basic principles while discussing efficiency and performance issues and demonstrating methods through examples and case studies from numerous application areas.