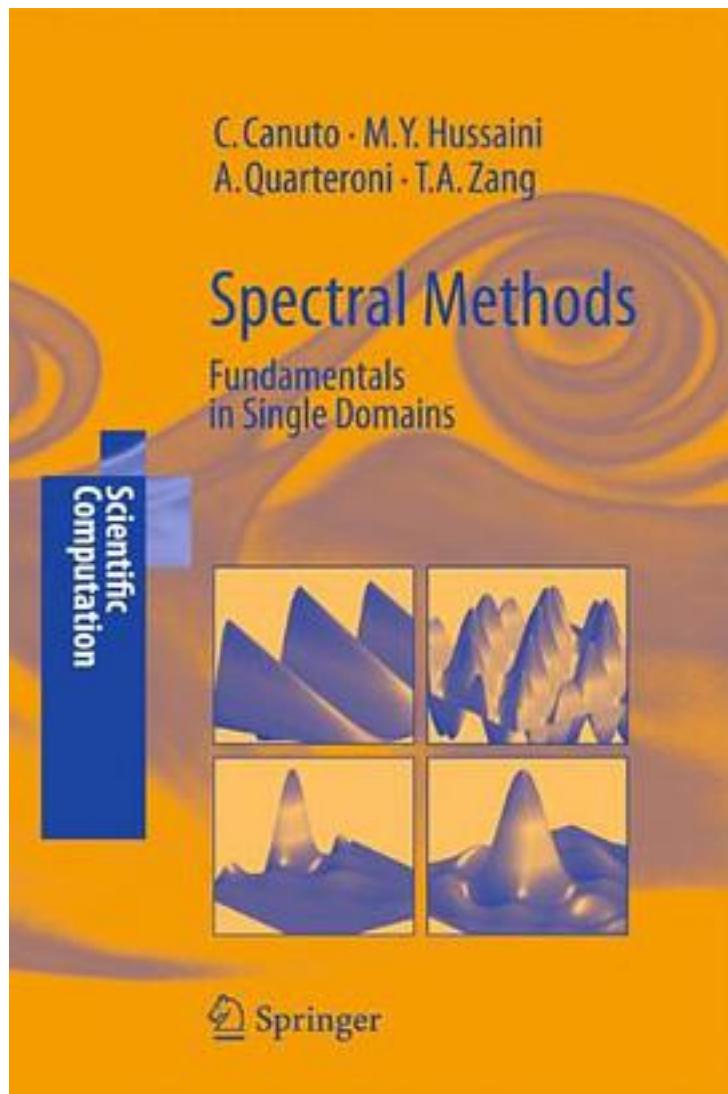


# Spectral Methods



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Spectral methods, particularly in their multidomain version, have become firmly established as a mainstream tool for scientific and engineering computation. While retaining the tight integration between the theoretical and practical aspects of spectral methods that was the hallmark of their 1988 book, Canuto et al. now incorporate the many improvements in the algorithms and the theory of spectral methods that have been made since then. This second new treatment, Evolution to Complex Geometries and Applications to Fluid Dynamics, provides an extensive overview of the essential algorithmic and theoretical aspects of spectral methods for complex geometries, in addition to detailed discussions of spectral algorithms for fluid dynamics in simple and complex geometries. Modern strategies for constructing spectral approximations in complex domains, such as spectral elements, mortar elements, and discontinuous Galerkin methods, as well as patching collocation, are introduced, analyzed, and demonstrated by means of numerous numerical examples. Representative simulations from continuum mechanics are also shown. Efficient domain decomposition preconditioners (of both Schwarz and Schur type) that are amenable to parallel implementation are surveyed. The discussion of spectral algorithms for fluid dynamics in single domains focuses on proven algorithms for the boundary-layer equations, linear and nonlinear stability analyses, incompressible Navier-Stokes problems, and both inviscid and viscous compressible flows. An overview of the modern approach to computing incompressible flows in general geometries using high-order, spectral discretizations is also provided. The recent companion book Fundamentals in Single Domains discusses the fundamentals of the approximation of solutions to ordinary and partial differential equations on single domains by expansions in smooth, global basis functions. The essential concepts and formulas from this book are included in the current text for the readera (TM)s convenience.

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