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Sinopsis

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The book examines theoretical and computational aspects of least-squares finite element methods(LSFEMs) for partial differential equations (PDEs) arising in key science and engineering applications. It is intended for mathematicians, scientists, and engineers interested in either or both the theory and practice associated with the numerical solution of PDEs.

The first part looks at strengths and weaknesses of classical variational principles, reviews alternative variational formulations, and offers a glimpse at the main concepts that enter into the formulation of LSFEMs. Subsequent parts introduce mathematical frameworks for LSFEMs and their analysis, apply the frameworks to concrete PDEs, and discuss computational properties of resulting LSFEMs. Also included are recent advances such as compatible LSFEMs, negative-norm LSFEMs, and LSFEMs for optimal control and design problems. Numerical examples illustrate key aspects of the theory ranging from the importance of norm-equivalence to connections between compatible LSFEMs and classical-Galerkin and mixed-Galerkin methods.