

Thomée, Vidar**Galerkin finite element methods for parabolic problems.** (English) Zbl 0884.65097
Springer Series in Computational Mathematics. 25. Berlin: Springer. x, 302 p. (1997).

The present monograph is an updated and essentially extended version of the author's textbook with the same title [Lecture Notes Math. 1054 (1984; Zbl 0528.65052)]. The textbook has already been the standard reference to the finite element method (FEM) for parabolic initial-boundary value problems.

The author has revised the 14 chapters of the textbook, and has added 4 new chapters, namely on semigroup methods, on multistep schemes, on incomplete iterative solution of the linear algebraic systems at the time levels, e.g. via multigrid methods, and on semilinear equations. Now, the outline of the book can be described as follows: In the introductory Chapter 1, the author recalls standard material from the FEM for elliptic problems and investigates the (spatially) semidiscrete and some fully discrete schemes for some simple model initial-boundary value problem. Chapters 2-6 are devoted to several extensions and generalizations of the results in the semidiscrete case. The next six chapters are concerned with fully discrete schemes. Chapters 13 and 14 are devoted to nonlinear problems. In the last four chapters, the author considers various modifications of the standard Galerkin FEM, namely mass lumping (Chap. 15), the H^1 and H^{-1} methods (Chap. 16), a mixed method (Chap. 17) and, finally, a singular problem (Chap. 18).

Reviewer: [U.Langer \(Linz\)](#)**MSC:**

- [65M60](#) Finite element, Rayleigh-Ritz and Galerkin methods for initial value and initial-boundary value problems involving PDEs
- [35K15](#) Initial value problems for second-order parabolic equations
- [35K55](#) Nonlinear parabolic equations
- [65M12](#) Stability and convergence of numerical methods for initial value and initial-boundary value problems involving PDEs
- [65M15](#) Error bounds for initial value and initial-boundary value problems involving PDEs
- [65-02](#) Research exposition (monographs, survey articles) pertaining to numerical analysis

Cited in **2** Reviews
Cited in **348** Documents**Keywords:**

Galerkin finite element methods; time discretization; error estimates; semidiscretization; monograph; parabolic initial-boundary value problems; semigroup methods; multistep schemes; multigrid methods; semilinear equations