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Introduction to projection-grid methods. (Vvedenie v proektsionno- setochnye metody). (Russian) [Zbl 0642.65037](#)
Moskva: Nauka. 416 p. R. 1.20 (1981).

This book is based upon an advanced course on projection-grid methods for numerical analysis of elliptic second-order boundary value problems of variational type and corresponding parabolic and hyperbolic evolution equations, which has been given regularly at the University of Novosibirsk and at the Moscow Physics and Technics Institute. It contains five chapters. The first one is dedicated to an abstract treatment by classical Ritz, Bubnov-Galerkin and Galerkin-Petrov methods of linear equations in a Hilbert space. Mostly, the operators considered here have a symmetric positive definite principal part. Special attention is given to the choice of basis functions while applying corresponding projection methods.

The latter analysis is continued in Chapter 2 which is entirely dedicated to special finite-dimensional approximations by piecewise polynomial functions in Sobolev spaces $W((\sup 1), (\sub 2))$. Special treatment is given to some spline methods. In Chapter 3, which is the central part of the book, projection methods and approximations by finite elements and finite differences are applied to classical second order elliptic variational boundary value problems and corresponding parabolic and hyperbolic evolution equations. In Chapter 4 finite-dimensional projections of integral identities (the latter are used for an equivalent reformulation of corresponding boundary value problems) are applied to second and fourth order elliptic boundary and eigenvalue problems.

Chapter 5 deals with projection-grid methods (Ritz, Bubnov-Galerkin) for the numerical solution of stationary problems in neutron transport theory, and makes the book essentially different from other courses on this topic. An appendix is dedicated to some operator splitting methods and local reduction to one-dimensional problems for the numerical treatment of multidimensional evolution equations.

MSC:

- [65J10](#) Numerical solutions to equations with linear operators (do not use [65Fxx](#))
- [65N30](#) Finite element, Rayleigh-Ritz and Galerkin methods for boundary value problems involving PDEs
- [65-02](#) Research exposition (monographs, survey articles) pertaining to numerical analysis
- [65N06](#) Finite difference methods for boundary value problems involving PDEs
- [65N25](#) Numerical methods for eigenvalue problems for boundary value problems involving PDEs
- [35J25](#) Boundary value problems for second-order elliptic equations
- [47A50](#) Equations and inequalities involving linear operators, with vector unknowns
- [35G10](#) Initial value problems for linear higher-order PDEs
- [35K25](#) Higher-order parabolic equations

Cited in **2** Reviews
Cited in **70** Documents

Keywords:

Ritz method; Bubnau-Galerkin methods; projection-grid methods; evolution equations; Galerkin-Petrov methods; Hilbert space; Sobolev spaces; spline methods; projection methods; finite elements; finite differences; eigenvalue problems; neutron transport theory; operator splitting methods; local reduction