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Multi-grid methods and applications. (English) [Zbl 0595.65106](#)

Springer Series in Computational Mathematics, 4. Berlin etc.: Springer-Verlag. XIV, 377 p. DM 178.00 (1985).

Author's summary: The characteristic feature of the multi-grid iteration is its fast convergence. The convergence speed does not deteriorate when the discretisation is refined, whereas classical iterative methods slow down for decreasing grid size. As a consequence one obtains an acceptable approximation of the discrete problem at the expense of computational work proportional to the number of unknowns, which is also the number of the equations in the system. It is not only the complexity which is optimal, also the constant of proportionality is so small that other methods can hardly surpass the multi-grid efficiency.

The previous characterization does not mean that there is a fixed multi-grid algorithm applying to all boundary value problems. There is rather a multi-grid technique fixing only the framework of the algorithm. The efficiency of the multi-grid algorithm depends on the adjustment of its components to the problem in question. Therefore it is one task of this book to describe the basic framework and the scope of several of the different multi-grid components.

The book is divided into five parts: Linear multi-grid algorithms, convergence analysis, special multi-grid applications, additional techniques, application to integral equations.

Reviewer: [S.F.McCormick](#)

MSC:

- [65N22](#) Numerical solution of discretized equations for boundary value problems involving PDEs
- [65F10](#) Iterative numerical methods for linear systems
- [65R20](#) Numerical methods for integral equations
- [65-02](#) Research exposition (monographs, survey articles) pertaining to numerical analysis
- [65F15](#) Numerical computation of eigenvalues and eigenvectors of matrices
- [65N25](#) Numerical methods for eigenvalue problems for boundary value problems involving PDEs
- [65N30](#) Finite element, Rayleigh-Ritz and Galerkin methods for boundary value problems involving PDEs
- [35J05](#) Laplace operator, Helmholtz equation (reduced wave equation), Poisson equation
- [35P15](#) Estimates of eigenvalues in context of PDEs
- [45B05](#) Fredholm integral equations

Cited in **10** Reviews
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Keywords:

[research survey](#); [multi-grid iteration](#); [fast convergence](#); [complexity](#); [efficiency](#); [Linear multi-grid algorithms](#); [convergence analysis](#)