KAREL REKTORYS

Metoda časové diskretizace a parciální diferenciální rovnice

SNTL — Nakladatelství technické literatury, Praha 1985.

Stran 364; 13 obrázků, 6 tabulek; cena Kčs 50,—.

The reviewed book by Karel Rektorys, Professor of Mathematics at the Technical University in Prague, is the Czech edition of his book entitled "The Method of Discretization in Time and Partial Differential Equations" (D. Reidel Publ., Dordrecht—Boston—London, 1982) The method of discretization in time (here referred to shortly as MDT), extending the classical Rothe method, can be successfully applied to evolution PDEs (partial differential equations) from both theoretical and numerical points of view, which is demonstrated in the book under review. We recall that the Rothe method consists in semi-discretization in time, while the spacial variables remain continuous. It should be remarked here that one-dimensional problems can be solved by this method directly on hybrid computers, where one variable may remain continuous. Then this method, which becomes very popular in contemporary hybrid computing, is usually referred to as CSDT (continuous space — discrete time).

Let us briefly go through the contents of the book. After an introduction (Chapter 1), in Chapter 2 the author presents a survey of variational theory of elliptic PDEs, which is auxiliary in context of MDT where sequences of elliptic problems are employed. In fact, this chapter is a shortened version of author's previous book "Variační metody v inženýrských problémech a v problémech matematické fyziky", (SNTL, Praha 1974, 2nd ed.: Variational Methods in Mathematics, Science and Engineering, D. Reidel Publ., Dordrecht—Boston, 1979). Part I (Chapters 3—9), entitled "Examples", is devoted to numerical practice in MDT and illustrates applications of the results stated in Part II (Chapters 10—21) "Theoretical aspects of MDT".

The "Examples" show how MDT can be applied to various types of evolution PDE, both linear and nonlinear, parabolic and hyperbolic, and also to some less traditional problems: an integrodifferential parabolic equation, a problem with an integral condition, and a rheology problem for a bar. The elliptic boundary value problems arrising by MDT are solved exactly, if possible, or again numerically using the well-known Ritz method; then such approximate solutions are called Ritz-Rothe approximations. Some results on numerical experiments and several short programs written in Basic are presented too. Each example is completed by references to the results from Part II concerning existence of a solution and convergence or error estimates of an approximate solution. Readers may find very interesting the study of efficiency of theoretical error estimates, which are shown to be particularly realistic if the data of evolution problems vary "slowly" in space variables, while they may be quite pesimistic if the data quickly oscillate (it concerns parabolic problems, in hyperbolic problems the situation is shown to be somewhat different).

Part II demonstrates that MDT can be readily used for the above outlined type of evolution PDE to obtain all theoretical results usually expected, i.e. existence, uniqueness, continuous dependence on data, and regularity of weak or very weak solutions, convergence and error estimates for the Rothe method, as well as convergence for the Ritz-Rothe method (of course, the uniqueness is proved directly, without using MDT). The explanation proceeds successively from simpler to more complicated problems, which makes it very clear. Thus Chapters 11 and 12 deal only with a linear parabolic PDE having homogeneous boundary and initial conditions and time-independent right hand side. In Chapter 13 the analysis is extended to non-homogeneous initial and boundary conditions (of a Dirichlet type) by introducing the notion of a very weak solution. Chapter 14 handles additional errors coming from approximation of the auxiliary elliptic problems, i.e. the mentioned Ritz-Rothe method, and shows its convergence. In Chapter 15 the analysis is further extended to the case when the right hand side as well as the coefficients depend Lipschitz continuously on time. In Chapter 16 it is shown that MDT can be used for nonlinear problems as well, namely for a parabolic problem with a uniformly monotone potential operator. The following two chapters are devoted to rather less traditional problems, namely to an integrodifferential parabolic equation (with a linear elliptic operator, homogeneous boudary and initial conditions, and a nonlinear integral operator) and to a parabolic problem with an integral condition (so-called problem of hydratational heat). It is shown that MDT quite easily yields needed apriori estimates when applied to these problems in such a way that "unpleasant" integral terms, depending on the solution only in the past, are discretized in an explicit manner, while the elliptic terms are treated, as typical for the Rothe method, in a fully implicit manner. Chapters 19 and 20 deal with a hyperbolic problem, first with homogeneous initial conditions, and afterwards with nonhomogeneous ones, using again the concept of a very weak solution. Very useful comments are collected in Chapter 21: Since the author has confined himself to somewhat special assumptions to make the explanation clear, the solutions has got some additional properties than they usually have (Lipschitz continuity instead of mere continuity, L_∞-estimates instead of L_2 ones, etc.). Furthermore, it is demonstrated how to weaken some of the assumptions (V-ellipticity, Lipschitz continuous right hand sides, time-independent boundary conditions of the Dirichlet type, and homogeneous boundary conditions of the Neumann or Newton type are replaced respectively by V-coercivity, square integrable right hand sides, and time-dependent or nonhomogeneous boundary conditions). It might have been interesting to mention there a generalization to spaces of distributions, like $L_2(0, T; W_2^{-k}(G))$, which may be very useful also in technical practice.

It should be emphasized that most of the results has been obtained by the author himself or by his students. Although the book cannot be considered (and it has not been intended) as a monograph about the evolution PDEs, it is undoubtedly a self-contained textbook about the technique of MDT, which has been proved as very powerful and universal and which finds broad usage among both engineers and theoretical mathematicians. The book is written in Rektorys's known bright and, at the same time, exact style, which may seem rather slow for experienced mathematicians, but which will be welcomed by those who works in applications and by advanced students. *Tomáš Roubíček*

JOHN E. MCNAMARA

Local Area Networks

An introduction to the technology

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Stran 165, 52 obrázků.

Knížka o lokálních počítačových sítích je věnována velmi aktuálnímu tématu. Význam lokálních sítí roste a začínáme se s nimi setkávat i u nás, i když zatím v omezeném rozsahu.

Dvanáct kapitol knihy je věnováno různým aspektům návrhu a využívání lokálních sítí. Jsou probrány a zhodnoceny používané struktury sítí, účel a způsoby jejich využívání. Výklad nejde do přílišných technických podrobností, spíše jsou probrány klady a zápory jednotlivých řešení a pozornost je soustředěna na efektivnost využívání a snadnost instalace, provozu i údržby.

Autor zahrnul do textu také úvod do programového vybavení s důrazem na ISO model komunikačních protokolů a upozorňuje na problémy s návazností jednotlivých protokolů a na dosavadní nízkou úroveň jejich standardizace.

Obsah knihy je srozumitelný a je přehledně uspořádán; většina kapitol obsahuje několik odkazů na literaturu pro hlubší porozumění tématu. Ke knize je připojen rejstřík a také slovníček s téměř 300 pojmy z oboru.

Kniha je určena studentům, vedoucím pracovníkům v oboru výpočetní techniky a komunikací i všem, kteří se chtějí blíže seznámit s lokálními počítačovými sítěmi.

Karel Šmuk