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Book reviews

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BOOK REVIEWS

Martin Bohner, Allan Peterson (eds.): ADVANCES IN DYNAMIC EQUATIONS ON TIME SCALES. Birkhäuser, Basel, 2003, 338 pages, ISBN 0-8176-4293-5.

The theory of *time scales* (an alternative terminology is *measure chains*) was introduced by Stefan Hilger in 1988 in his dissertation and the basic ideas of this theory are summarized in his paper published in Result. Math. 18 (1990), 18–56. A time scale $\mathbb{T}$ is any closed subset of real numbers $\mathbb{R}$. For a function $f\colon \mathbb{T} \to \mathbb{R}$, a generalized derivative f^{Δ} is defined in such a way that it reduces to the usual derivative f' if $\mathbb{T} = \mathbb{R}$ and to the forward difference Δf if $\mathbb{T} = \mathbb{Z}$—the set of integers. A *dynamic equation* on time scale is the equation for an unknown function which appears in the equations with its derivatives (possibly of higher order). Hence, the theory of dynamic equations on time scales unifies the theory of differential and difference equations (and a time scale dynamic equation reduces to a differential equation if $\mathbb{R} = \mathbb{T}$ and to a difference equation if $\mathbb{T} = \mathbb{Z}$.

The book can be regarded as a continuation of the previous author's monograph *Dynamic Equations on Time Scales: An Introduction with Applications*, Birkhäuser, Boston, 2001. The reviewed book consists of ten chapters written by 21 time scale specialists and provides an overview of the recent advances in the theory of time scales. It is to be emphasized that the book is not only a collection of papers written by different authors, but it is a thorough introduction to different but connected areas of the research in the theory of dynamic equations on time scales and related topics.

Here is the contents of the book together with the authors of the particular chapters:

1. Introduction to Time Scale Calculus (M. Bohner, G. Guseinov, A. Peterson)
2. Some Dynamic Equations (E. Akin-Bohner, M. Bohner)
3. Nabla Dynamic Equations (D. Anderson, J. Bullock, L. Erbe, A. Peterson, H. N. Tran)
4. Second Order Self-Adjoint Equations with Mixed Derivatives (K. Messer)
5. Riemann and Lebesgue Integration (M. Bohner, G. Guseinov)
6. Lower and Upper Solutions of Boundary Value Problems (E. Akin-Bohner, F. Merdivici Atici, B. Kaymakcalan)
7. Positive Solutions of Boundary Value Problems (D. Anderson, R. Avrey, J. Davis, J. Henderson, W. Yin)
8. Disconjugacy of Higher Order Dynamic Equations (P. Eloe)
9. Boundary Value Problems on Infinite Intervals (R. Agarwal, M. Bohner, D. O'Regan)
10. Symplectic Dynamic Systems (O. Došlý, S. Hilger, R. Hilscher).

The titles of chapters are sufficiently representative to see what is their contents. The editors carefully coordinated the contributions of particular chapters so that the notation throughout the book is the same and there is also a unifying List of References and Index for the whole book.

The book can be used as a textbook for a second course in dynamic equations (among other, it contains 114 exercises included throughout the chapters) and is an indispensable monograph for every researcher in the field of dynamic equations on time scale and related topics.

Ondřej Došlý, Brno

Leo Corry: MODERN ALGEBRA AND THE RISE OF MATHEMATICAL STRUCTURES. Birkhäuser, Basel, second revised edition, 2003, 451 pages, ISBN 3-7643-7002-5, EUR 65.–.

The first edition of this excellent book was published in 1996 (Science Networks-Historical Studies, Vol. 17). It was improved, extended and printed in 2003 (Birkhäuser). The second revised edition explains what are modern mathematical structures, describes how they were discovered in the nineteenth century and how they were adapted and extended in the modern mathematical research in the twentieth century.

The author divided the book into two different parts. The first part of the book *Structures in the Images of Mathematics* consists of five chapters. The first chapter analyses the algebraic research in the late nineteenth century and at the beginning of the twentieth century. The achievements of C. Jordan, O. Hölder, H. Weber, B. L. van der Waerden and other mathematicians are presented. From Chapter 2 to Chapter 5 the rise of the structural approach and the first conception of modern algebra are discussed in deep detail. The main aim of these chapters is to explain the discovery and development of modern algebra from the works of R. Dedekind to the works of E. Noether. The author describes the most important discoveries of R. Dedekind, D. Hilbert, K. Hensel, E. Steinitz, A. Loewy, A. H. Fraenkal and E. Noether. The most important milestones of the transformation of "classical" algebra into "modern" algebraical structures are pointed out. The readers can recognize the process of the development of algebraic number theory (themes as ideal prime numbers, algebraic invariants, theory of p-adic numbers etc. are included) and the rise of axiomatic algebra (themes as Hilbert's axiomatic approach, structural image of algebra, postulations, axioms for p-adic systems, theory of rings and ideals etc. are included).

The second part of the book *Structures in the Body of Mathematics* is divided into four chapters and deals with three different mathematical theories and their historical roots. First, the author explains the birth of the so-called Oystein Ore's lattice as the theory of structures which was made between 1935 and 1945. The second attempt to create modern structural algebra is associated with Bourbaki's works. The deep details of Bourbaki's remarkable ideas in set theory, algebra, general topology and commutative algebra are discussed in the next chapters. The author provides an interpretation of connections between the general non-formalized idea of a mathematical structure and the axiomatically formalized one. The third theme described in that part is the theory of categories. The author analyses the root of that theory which crystallized in the USA between 1943 and 1960. The development of that theory in the next decade is described at the end of the book. The extensive bibliography, author and subject index are included at the end of the book.

This great book can be recommended to historians of mathematics, mathematicians and students who are interested in modern structural algebra and its development during the late ninetieth century and the twentieth century. It can be also interesting for some philosophers and historians of sciences which study and analyse the role of the development of scientific ideas.

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