Journal of Difference Equations and Applications

Book review

Hassan Sedaghat

a Department of Mathematics , Virginia Commonwealth University , P.O. Box 842014,
Richmond, VA, 23284-2014, USA E-mail:
Published online: 25 Jan 2007.

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Partial Difference Equations by Sui Sun Cheng
Taylor and Francis, New York, 2003, 267 pages, $84.95, ISBN: 0-415-29884-9

Partial difference equations are what the modern digital computer actually sees when it is programmed to "solve" differential equations. These equations have been one of the major tools of numerical analysis for estimating the solutions of differential equations in various scientific fields, especially the major equations of mathematical physics. But are partial difference equations significant by themselves, especially in serving as primary tools for mathematical modelling of discrete phenomena?

The book "Partial Difference Equations" by Sui Sun Cheng represents a substantial effort in providing a positive answer to the above question. This is not a numerical analysis book as it aims to treat partial difference equations as objects significant in themselves. In the first chapter, models involving partial difference equations are presented, e.g., heat diffusion and control, temperature distribution and population growth. Many interesting examples are presented in this chapter.

The tone of the book changes noticeably after Chapter 1 and more emphasis is placed on theorems and proofs. In Chapter 2 the basic concepts and definitions and some useful background material are presented and Chapter 3 is devoted to a study of sequences that serve as solutions of partial difference equations. Chapter 4 discusses maximum principles and discrete Wirtinger's inequalities. Chapter 5 illustrates how to obtain explicit solutions of certain types of partial difference equations using operator and other methods. In Chapter 6 stability concepts are discussed and results are presented for the stability of equations over cylinders, half-planes, quadrants and finite domains. In Chapter 7 criteria for the existence of solutions for various types of partial difference equations are obtained using a number of techniques and Chapter 8 derives conditions that imply nonexistence of eventually positive solutions.

The author's style of writing is clear and concise, although the efficiency of presentation coupled with the complexity of some calculations tend to place the book out of reach of most undergraduate students. It is suitable mainly for graduate students and researchers who are interested in differential and difference equations and their applications. Given the great range of discrete dynamical phenomena that partial difference equations can cover, it is likely that the significance of these equations as tools for modelling will substantially increase in such rapidly developing areas as biology and medicine. With some patience and

diligence, the reader of this book will gain a good foothold in the increasingly important and fruitful area of partial difference equation.

Hassan Sedaghat
Department of Mathematics
Virginia Commonwealth University
P.O. Box 842014
Richmond, VA 23284-2014
USA
Email: hsedagha@vcu.edu