Hindawi Publishing Corporation
Journal of Applied Mathematics
Volume 2013, Article ID 156136, 3 pages
http://dx.doi.org/10.1155/2013/156136

Editorial

Advances in Matrices, Finite and Infinite, with Applications

P. N. Shivakumar,[1] Panayiotis Psarrakos,[2] K. C. Sivakumar,[3] and Yang Zhang[1]

[1] *Department of Mathematics, University of Manitoba, Winnipeg, MB, Canada R3T 2N2*
[2] *Department of Mathematics, School of Applied Mathematical and Physical Sciences, National Technical Univeristy of Athens, Zografou Campus, 15780 Athens, Greece*
[3] *Department of Mathematics, Indian Institute of Technology Madras, Chennai 600 036, India*

Correspondence should be addressed to P. N. Shivakumar; shivaku@cc.umanitoba.ca

Received 13 June 2013; Accepted 13 June 2013

In the mathematical modeling of many problems, including, but not limited to, physical sciences, biological sciences, engineering, image processing, computer graphics, medical imaging, and even social sciences lately, solution methods most frequently involve matrix equations. In conjunction with powerful computing machines, complex numerical calculations employing matrix methods could be performed sometimes even in real time. It is well known that infinite matrices arise more naturally than finite matrices and have a colorful history in development from sequences, series and quadratic forms. Modern viewpoint considers infinite matrices more as operators defined between certain specific infinite-dimensional normed spaces, Banach spaces, or Hilbert spaces. Giant and rapid advancements in the theory and applications of finite matrices have been made over the past several decades. These developments have been well documented in many books, monographs, and research journals. The present topics of research include diagonally dominant matrices, their many extensions, inverse of matrices, their recursive computation, singular matrices, generalized inverses, inverse positive matrices with specific emphasis on their applications to economics like the Leontief input-output models, and use of finite difference and finite element methods in the solution of partial differential equations, perturbation methods, and eigenvalue problems of interest and importance to numerical analysts, statisticians, physical scientists, and engineers, to name a few.

The aim of this special issue is to announce certain recent advancements in matrices, finite and infinite, and their applications. For a review of infinite matrices and applications, see P. N. Shivakumar, and K. C. Sivakumar (Linear Algebra Appl., 2009). Specifically, an example of an application can be found in the classical problem "shape of a drum," in P. N. Shivakumar, W. Yan, and Y. Zhang (WSES transactions in Mathematics, 2011). The focal themes of this special issue are inverse positive matrices including M-matrices, applications of operator theory, matrix perturbation theory, and pseudospectra, matrix functions and generalized eigenvalue problems and inverse problems including scattering and matrices over quaternions. In the following, we present a brief overview of a few of the central topics of this special issue.

For M-matrices, let us start by mentioning the most cited books by R. Berman and R. J. Plemmons (SIAM, 1994), and by R. A. Horn and C. R. Johnson (Cambridge, 1994), as excellent sources. One of the most important properties of invertible M-matrices is that their inverses are nonnegative. There are several works that have considered generalizations of some of the important properties of M-matrices. We only point out a few of them here. The article by D. Mishra and K. C. Sivakumar (Oper. Matrices, 2012), considers generalizations of inverse nonnegativity to the Moore-Penrose inverse, while more general classes of matrices are the objects of discussion in D. Mishra and K. C. Sivakumar (Linear Algebra Appl., 2012), and A. N. Sushama, K. Premakumari and K. C. Sivakumar (Electron. J. Linear Algebra 2012).

A brief description of the papers in the issue is as follows.

In the work of Z. Zhang, the problem of solving certain optimization problems on Hermitian matrix functions is studied. Specifically, the author considers the extremal inertias and ranks of a given function $f(X, Y) : \mathbb{C}^{m\times n} \to \mathbb{C}^{m\times n}$ (which is defined in terms of matrices A, B, C, and D