

# Matrices with Positive Principal Minors: Theory and Applications

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## Overview

Matrices with positive principal minors, known as P-matrices, play an important role in a wide range of applications, including the linear complementarity problem, global univalence of maps, differential inclusion problems, interval matrices and computational complexity.

Of particular concern is the ability to decide as efficiently as possible, whether an  $n$ -by- $n$  matrix is a P-matrix or not, referred to as the P-problem. It is receiving attention due to its inherent computational complexity. Motivated by the P-problem and questions about the spectra of P-matrices, in this course we will address the need to construct (generic and special) P-matrices for purposes of experimentation, as well as theoretical and algorithmic development. To this end, we will provide a review of

- (i) basic properties of P-matrices and operations that preserve them;
- (ii) techniques to generate P-matrices;
- (iii) numerical methods to detect P-matrices;
- (iv) manifestations of P-matrices in various mathematical contexts.

The objectives include a review of classical and modern theory of P-matrices with the purpose of promoting research activity in this important area. Emphasis will be given in applications with the primary goals being to motivate young researchers and inform them of current mathematical challenges.

<b>Modules</b>	December 18 - December 22, 2017 (1 week): 13 hrs lectures and 6 hrs Tutorials. <b>Number of participants for the course will be limited to sixty.</b>
<b>You Should Attend If...</b>	<ul style="list-style-type: none"> <li>▪ you are a final year Master's degree student in Mathematics, then you can apply</li> <li>▪ you are a researcher (Ph.D. scholar or PDF or a Faculty) in Mathematics or Physics, then you can apply</li> <li>▪ you are an engineer with a background in first course in Linear Algebra, then you can apply</li> </ul>
<b>Fees</b>	<p>The participation fees for taking the course is as follows:</p> <p><b>Participants from abroad : US \$200 /-</b>  <b>Industry/ Research Organizations: Rs. 8000 /-</b>  <b>Academic Institutions: Faculty:Rs.5000/,</b>  <b>other Researchers: Rs.2000/-</b></p> <p>Modes of payment:</p> <p>Online transfer:</p> <p>Account Name: CCE IIT Madras  Acc. No.: 36401111110  Branch: SBI, IIT Madras Branch, Chennai  IFSC Code: SBIN0001055</p> <p>Demand draft:</p> <p>In favour of "Registrar, IIT Madras" payable at Chennai. The demand draft is to be sent to the Course Coordinator at the address given below.</p> <p>Prof. K. C. Sivakumar  Department of Mathematics  IIT Madras Chennai 600036</p> <p>The above fee includes all instructional materials, computer use for tutorials and assignments, 24 hr free internet facility. The participants will be given accommodation along with boarding on payment basis.</p>



Professor Michael J. Tsatsomeros, Department of Mathematics and Statistics, Washington State University, Pullman, USA is a leading mathematician working in the areas of linear algebra, matrix analysis, especially the theory of nonnegative matrices and their generalizations. Particular interests include the numerical range; graphs and patterns associated with matrices; numerical linear algebra; applications in dynamical systems and control theory. He is an Editor-in-Chief of the internationally reputed journal, The Electronic Journal of Linear Algebra.



Professor K.C. Sivakumar, the host faculty, has been with the Department of Mathematics, IIT Madras for the past 14 years. His research areas include Functional Analysis and Mathematical Programming. Presently he is working on problems in matrix analysis, especially concerning nonnegative matrices/operators and their applications in the theory of the standard and the semidefinite linear complementarity problems.