Inverse Eigenvalue Problems : Theory, Methods and Applications

Lecturer : Biswa Nath Datta, IEEE Fellow

Distinguished Research Professor ,

Northern Illinois University

URL : www.math.niu.edu/~dattab

The Inverse Eigenvalue Problem (IEP) concerns constructing a matrix (or matrices) from the knowledge of the complete or a partial spectral data. Remarkably, the IEP arises in a wide variety of practical applications, mechanical vibrations, control theory, structural dynamics, aerospace engineering, and space sciences.

Because of intrinsic difficulties, these problems, especially those associated with a quadratic matrix pencil, have not been very well studied in the literature. Indeed, the book, Numerical Linear Algebra and Applications, by this lecturer is the only numerical linear algebra book that contains some in-depth discussions on the quadratic matrix eigenvalue problem.

The course will cover all major aspects of theory, methods and applications of the inverse eigenvalue problems, with a special emphasis on numerical and optimization methods and their applications to science and engineering.

The following topics will be covered:

- An Introduction to Inverse Eigenvalue Problems and their applications to science and engineering.
- A brief overview of the numerical methods for the standard, generalized and quadratic eigenvalue problems and their applications.
- Computational and Optimization Methods for Generalized and Quadratic Partial Inverse Eigenvalue Problems arising the control theory and mechanical vibrations.
- Quadratic Model Updating: Theory and Computational and Optimization Methods and Applications to structural dynamics.
- Future Directions of Research and Open Research Problems.

Intended Audience: Faculty and post-graduate students in mathematics, computer science, and electrical, mechanical, civil, industrial, aerospace, automobile, and structural engineering.

Text Books

- Numerical Linear Algebra and Applications by Biswa Nath Datta, second edition, SIAM, 2010 (Indian Edition by Prentice Hall of India).
- Inverse Eigenvalue Problems : Theory, Algorithms and Applications by Moody Chu and Gene Golub, Oxford University Press
- Finite Element Model Updating in Structural Dynamics by Michael Friswell and John Mottershead, 1995.