Recent Advances on Computational Methods for Structured Inverse Eigenvalue Problems for Quadratic Matrix and Operator Pencils: Linking Mathematics to Industry

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The inverse eigenvalue problems for the matrix quadratic pencil $P(\lambda) = \lambda^2 M + \lambda D + K$, to be considered here, are the problems of modifying the coefficient matrices M, D, and K of $P(\lambda)$ in such a way that the spectrum of the modified pencil contains a small set of prescribed numbers while the remaining large number of eigenvalues and the corresponding eigenvectors remain unchanged.

The inverse eigenvalue problems for an operator pencil $P_0(\lambda) = \lambda^2 M + \lambda D + K$, where M, D, and K are operators with respect to certain inner product in a Hilbert space, can be similarly defined.

These inverse problems are industrial problems and arise in suppressing dangerous vibrations, caused by external forces resulting total or partial destructions of the structures, such as building, bridges, highways, automotive, air and space crafts, and in updating theoretical finite element models for use of future industrial manufacturing with confidence.

In this talk, I shall give an overview of some of the recent developments on the practical real-life solutions of these problems. The talk will conclude with some interesting future research problems in this area. The talk is interdisciplinary in nature and will be of interests to mathematicians, computational and applied mathematicians, and control and vibration engineers.