PRAIRIE MATHEMATICS COLLOQUIUM

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Recent Trends on the Inverse Eigenvalue Problem for Graphs

Mathematics and Statistics

Date: **Thursday** November 5, 2020
Time: Social tea break at 2:00 PM, talk at 2:30 PM
Zoom link: https://zoom.us/j/95446214700

Abstract: Given a simple graph $G = (V, E)$ with $V = \{1, 2, \ldots, n\}$, we associate a collection of real n-by-n symmetric matrices governed by G, and defined as $S(G)$ where the off-diagonal entry in position (i, j) is nonzero iff i and j are adjacent.

The inverse eigenvalue problem for G (IEP-G) asks to determine if a given multi-set of real numbers is the spectrum of a matrix in $S(G)$. This particular variant on the IEP-G was born from the research of Parter and Wiener concerning the eigenvalue of trees and evolved more recently with a concentration on related parameters such as: minimum rank, maximum multiplicity, minimum number of distinct eigenvalues, and zero forcing numbers. An exciting aspect of this problem is the interplay with other areas of mathematics and applications. A novel avenue of research on so-called "strong properties" of matrices, closely tied to the implicit function theorem, provides algebraic conditions on a matrix with a certain spectral property and graph that guarantee the existence of a matrix with the same spectral property for a family of related graphs.

In this lecture, we will review some of the history and motivation of the IEP-G. Building, on the work Colin de Verdière, we will discuss some of these newly developed "strong properties" and present a number of interesting implications pertaining to the IEP-G.

This event is supported by PIMS.

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