Keivan Hassani Monfared - Publications

Inverse spectral problems for linked vibrating systems and structured matrix polynomials 2017+

Keivan Hassani Monfared and Peter Lancaster, *Under review*

We show that for a given set of nk distinct real numbers Λ, and k graphs on n nodes, $G_0, G_1, \cdots, G_{k-1}$, there are real symmetric $n \times n$ matrices A_s, $s = 0, 1, \ldots, k$ such that the matrix polynomial $A(z) := A_k z^k + \cdots + A_1 z + A_0$ has proper values Λ, the graph of A_s is G_s for $s = 0, 1, \ldots, k-1$, and A_k is an arbitrary nonsingular (positive definite) diagonal matrix. When $k = 2$, this solves a physically significant inverse eigenvalue problem for linked vibrating systems.

A structured inverse spectrum problem for infinite graphs 2017+

Keivan Hassani Monfared and Ehssan Khanmohammadi, *Under review*

It is shown that for a given infinite graph G on countably many vertices, and a bounded, countably infinite set of real numbers Λ there is a symmetric matrix whose graph is G and its spectrum is the closure of Λ.

Existence of a Not Necessarily Symmetric Matrix with Given Distinct Eigenvalues and Graph 2017

Keivan Hassani Monfared, *Linear Algebra and its Applications* 1–11

For given distinct numbers $\lambda_1 \pm \mu_1 \imath, \lambda_2 \pm \mu_2 \imath, \ldots, \lambda_k \pm \mu_k \imath \in \mathbb{C} \setminus \mathbb{R}$ and $\gamma_1, \gamma_2, \ldots, \gamma_l \in \mathbb{R}$, and a given graph G with a matching of size at least k, we will show that there is a real matrix whose eigenvalues are the given numbers and its graph is G. In particular, this implies that any real matrix with distinct eigenvalues is similar to a real, irreducible, tridiagonal matrix.

The nowhere-zero eigenbasis problem for a graph 2016

Keivan Hassani Monfared and Bryan L. Shader, *Linear Algebra and its Applications* 296–312

Using previous results and methods, it is shown that for any connected graph G on n vertices and a set of n distinct real numbers Λ, there is an $n \times n$ real symmetric matrix A whose graph is G, its spectrum is Λ, and none of the eigenvectors of A have a zero entry.

On the principal permanent rank characteristic sequences of graphs and digraphs 2016

Keivan Hassani Monfared, Paul Horn, Franklin H. J. Kenter, Kathleen Nowak, John Sinkovic, and Josh Tobin, *Electronic Journal of Linear Algebra* 187–199

Given an $n \times n$ real matrix A, the principal characteristic perrank sequence of A is defined as $r_0, r_1, r_2, \ldots, r_n$, where for $k \geq 1$, $r_k = 1$ iff A has a principal submatrix of size k with nonzero permanent, and $r_0 = 1$ iff A has a zero on its main diagonal. We study the following inverse problem: given a sequence $r_0 r_1 \cdots r_n$ of zeros and ones, does there exist an $n \times n$ real matrix which achieves this sequence? As a result, we characterize all the sequences corresponding to (symmetric) entry-wise nonnegative matrices, and provide some results for the skew-symmetric case.

Spectral characterization of matchings in graphs 2016

Keivan Hassani Monfared and Sudipta Mallik, *Linear Algebra and Its Applications* 407–419

We provide a characterization of graphs with matching number k in terms of what spectra they can realize as skew-symmetric matrices.

The λ-τ structured inverse eigenvalue problem 2015

Keivan Hassani Monfared and Bryan L. Shader, *Linear and Multilinear Algebra* 2275–2300

For a matrix A let $A(\{r, s\})$ denote the principal submatrix obtained form A by removing rows and columns r and s. Let T be a tree on n vertices which satisfies some necessary combinatorial restriction, Λ a set of n distinct real numbers, M a set of $n-2$ distinct real numbers, and r and s two distinct fixed vertices of T. Also, assume that M and L satisfy second degree strict Cauchy interlacing inequalities and some genericity conditions. Using various combinatorial techniques it is shown that there is a real symmetric matrix A whose graph is T, spectrum of A is Λ and spectrum of $A(\{r, s\})$ is M. Then, using Jacobian method this result was extended to any supergraph of this family of trees. Also, some consequences of these results related to perturbations of diagonal entries of a matrix are presented.

Construction of real skew-symmetric matrices from interlaced spectral data, and graph 2015

Keivan Hassani Monfared and Sudipta Mallik, *Linear Algebra and Its Applications* 241–263

We provide analogues of the results presented in 2 for skew-symmetric matrices. This is first shown for a family of trees with nearly even branching at a vertex v (NEB trees) using various combinatorial techniques. Then the results are extended to any supergraph of such trees using the Jacobian method. Let G be a connected graph on n vertices, Λ a set of n distinct purely imaginary numbers which is closed under negation, and M a set of $n-1$ distinct purely imaginary numbers closed under negation which strictly interlaces Λ. Also, let v be a vertex of G. It is shown that if G has a spanning tree which is NEB at v, then there is a real skew-symmetric matrix A whose graph is G, its spectrum is Λ, and the spectrum of $A(v)$ is M. Some properties of NEB trees are also studied.

Construction of matrices with a given graph and prescribed interlaced spectral data 2013

Keivan Hassani Monfared and Bryan L. Shader, *Linear Algebra and Its Applications* 4348–4358

For a matrix A let $A(v)$ denote the principal submatrix obtained form A by removing its v-th row and column. In a 1989 paper, Duarte showed that for any given tree T on n vertices, Λ a set of n distinct real numbers, M a set of $n-1$ distinct real numbers that strictly interlaces Λ, and i a fixed vertex of T, there is a real symmetric matrix A whose graph is T, spectrum of A is Λ and spectrum of $A(v)$ is M. In this paper we develop a method, called the Jacobian method, and show that Duarte's result holds for any connected graph.

On the existence of nowhere-zero vectors for linear transformations 2010

Saeed Akbari, Keivan Hassani Monfared, Mohammad Jamaali, Ehssan Khanmohammadi, and Dariush Kiani, *Bulletin of the Australian Mathematical Society* 480–487

If for a matrix A there is a vector x such that the vectors x and Ax have no zero entries, then A is called to have the AJT property. In this paper we make further progress on the Alon-Jaeger-Tarsi (AJT) Conjecture, using combinatorial, probabilistic, and linear algebraic methods. The AJT conjecture asserts any nonsingular matrix over a field with at least 4 elements has the AJT property. It is shown that any nonzero matrix is similar to an AJT matrix, and some necessary and some sufficient conditions for a matrix to have the AJT property are given. Also, we provide a sharp bound for the number of the elements of the field in terms of the size of the matrix.