Eigenvalues and graphs
Les valeurs propres et les graphes
(Org: **Karen Meagher** and/et **Hermie Monterde** (University of Regina))

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Gluing via block similarity matrices for distance matrices

A common method to form cospectral graphs is to glue two graphs on a common vertex. The justification is often carried out by the use of combinatorial interpretations of coefficients of characteristic polynomials that can be readily computed using sparseness of the related matrices. However, if the matrix is dense, e.g. a distance matrix, this approach does not work.

In this talk we will look at how to use block similarity matrices to form cospectral constructions via gluing which work for many classes of matrices, including the adjacency, Laplacian, signless Laplacian, distance, and generalized distance matrix.

This work is the culmination of two REU projects that happened at Iowa State University in recent years.

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On Ramanujan derangement graphs arising from linear groups of degree two

Let X be a connected non-bipartite k-regular graph on n vertices with eigenvalues $\lambda_1 > \lambda_2 \geq \ldots \geq \lambda_n$, and let $\lambda(X) := \max\{|\lambda_2|, |\lambda_n|\}$. The graph X is called a Ramanujan graph if $\lambda(X) \leq 2\sqrt{k-1}$.

Given a finite transitive group $G \leq \mathrm{Sym}(\Omega)$, the derangement graph Γ_G is the graph whose vertex set is G, and two elements g and h of G are adjacent if hg^{-1} is a derangement, that is, a fixed-point-free permutation. In this talk, we will show that Γ_G is a Ramanujan graph for every subgroup $\mathrm{SL}_2(\mathbb{F}_q) \trianglelefteq G \leq \mathrm{GL}_2(\mathbb{F}_q)$ acting transitively on the non-zero vectors of $\mathbb{F}_q^2$ such that $[\mathrm{GL}_2(q) : G]$ is odd.

This is based on joint work with Roghayeh Maleki.

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