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*Graph Density Inequalities and Sums of Squares*

Many results in extremal graph theory can be formulated as inequalities on graph densities. While many inequalities are known, many more are conjectured. A standard tool to establish an inequality is to write the expression whose nonnegativity needs to be certified, as a sum of squares. This technique has had many successes but also limitations. In this talk I will describe new restrictions that show that several simple inequalities cannot be certified by sums of squares. These results extend to the powerful frameworks of flag algebras by Razborov and graph algebras by Lovasz and Szegedy. Joint work with Greg Blekherman, Annie Raymond, and Mohit Singh