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*Equitable Decompositions of Graphs: Using any symmetry of a graph (or matrix) to simplify eigenvalue and eigenvector computations.*

In this talk I will discuss connections between the symmetries (automorphisms) of a graph and its spectral properties. Whenever a graph has a symmetry, i.e. a nontrivial automorphism  $\phi$ , it is possible to use  $\phi$  to decompose any matrix  $M$  appropriately associated with the graph. The result of this decomposition is a number of strictly smaller matrices whose collective eigenvalues are the same as the eigenvalues of the original matrix  $M$ . Some of the matrices that can be decomposed are the graph's adjacency matrix, Laplacian matrix, etc. Because this decomposition has connections to the theory of equitable partitions it is referred to as an equitable decomposition. I will also discuss a new (sharp) bound on the number of simple eigenvalues of undirected graphs. (Received September 20, 2017)