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Amanda Ellis Francis* (amanda@mathematics.byu.edu), 275 TMCB, Department of Mathematics, Brigham Young University, Provo, UT 84602, and **B Webb, W Barrett, R Echols** and **D Sorenson**. *Equitable Decompositions Using Automorphisms of Graphs*. Preliminary report.

It is well-known that for any equitable partition of a graph, the characteristic polynomial of the divisor matrix of the partition divides the characteristic polynomial of the original adjacency matrix. In this talk I will consider those equitable partitions arising from automorphisms of the graph and present new results which show that the original adjacency matrix is similar to a direct sum of smaller matrices, one of which is exactly the divisor matrix of the partition. Further, our results give bounds on the number of simple eigenvalues in the spectra of the graph, and relate this matrix decomposition to a decomposition of the original graph into smaller graphs. These results hold for any edge-weighted directed graph with loops (and its corresponding weighted adjacency matrix) and can be applied to many interesting matrices, including the various Laplacians, distance matrices, etc. (Received September 21, 2015)