1145-37-89 **Louis M Pecora***, louis.pecora@nrl.navy.mil, and **Francesco Sorrentino**, **Aaron Hagerstrom**, **Abu Siddique**, **Joseph Hart**, **Rajarshi Roy** and **Thomas Murphy**. *Dealing with Cluster Synchronization in undirected networks.*

Complex networks of oscillators or other dynamical systems can break down into subsets of nodes that are synchronized among each other, but not synchronized to node in other subsets. We call these subsets Clusters. For large networks finding such clusters is difficult to humanly impossible. The solution is to use computational group theory to find the symmetries of the network and, hence, the clusters. In addition, other clusters that are not formed from symmetries are also possible. Such clusters are called equitable clusters or Laplacian clusters. It turns out these are intimately related to the symmetry clusters and we can construct all of them from the original symmetry clusters making the symmetry clusters the building blocks of all synchronized clusters in undirected networks. We can also use group representation theory to derive the variational equations for the stability of the symmetry, equitable, and Laplacian clusters along with their desynchronization bifurcation modes. I also show some experimental results that demonstrate the success of our analysis.

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