

**Abstract:**

Big data arising in various complex systems can often be conveniently represented using graphs or networks. If the components of the complex system of interest are thought of as vertices, then the pairwise interactions between different components, detected based on the available data (e.g., time series), can be naturally described by edges, yielding a network representation of the complex system. Given a network representation of a complex system, studying the community structures or performing cluster analysis is of a great practical interest. Oftentimes, clusters are modeled using various graph-theoretic structures relaxing certain characteristics of the classical clique concept, referred to as clique relaxations. Due to their ubiquitous nature, clique relaxations have attracted a considerable attention of researchers working in diverse fields. This talk first discusses a rigorous, systematic framework for studying the clique relaxation models from optimization perspective and then focuses on new results obtained for specific clique relaxation structures.