Approximating minimum cost k-node-connected spanning subgraphs

László Végh (LSE)

Given an undirected graph with costs on the edges and a positive integer k, consider the problem of finding a minimum cost spanning subgraph that is k-node-connected. We present a 6-approximation algorithm for this NP-complete problem, assuming that the number of nodes is at least $k^3(k-1)+k$. This gives the first constant factor approximation for the problem.

For edge-connectivity variants, constant factor approximation can be achieved using the iterative rounding of the linear programming relaxation, a powerful technique developed by Jain. Whereas it has been long known that iterative rounding cannot yield a constant factor approximation for node-connectivity on arbitrary input graphs, we show that it does give a 2-approximation for a restricted class of instances. We apply a combinatorial preprocessing, based on the Frank–Tardos algorithm for k-outconnectivity, to transform any input into such an instance. This is a joint work with Joseph Cheriyan.