A Multilevel Bilinear Programming Algorithm for the Vertex Separator Problem

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Given a simple undirected graph G, the vertex separator problem (VSP) is to find the smallest collection of vertices whose removal separates G into two disconnected sets of approximately the same size. Applications include VLSI design, sparse matrix factorizations, and hypergraph partitioning. In this talk, we present a multilevel algorithm for solving large-scale instances of this VSP. A key feature of our algorithm is in the refinement phase. While most modern multilevel graph partitioners carry out refinements using node-swapping heuristics such as the Fiduccia Mattheyses algorithm, our algorithm refines solutions by solving a recently discovered continuous bilinear programming formulation of the VSP. Numerical results are given comparing our algorithm with the VSP solver METIS, which employs traditional node-swapping heuristics.