Karypis, George; **Kumar, Vipin**
A fast and high quality multilevel scheme for partitioning irregular graphs. (English)
Zbl 0915.68129
SIAM J. Sci. Comput. 20, No. 1, 359-392 (1999).

Summary: Recently, a number of researchers have investigated a class of graph partitioning algorithms that reduce the size of the graph by collapsing vertices and edges, partition the smaller graph, and then uncoarsen it to construct a partition for the original graph [*T. Bui* and *C. Jones,* Proc. of the 6th SIAM Conference on Parallel Processing for Scientific Computing, 445-452 (1993); *B. Hendrickson* and *R. Leland*, A multilevel algorithm for partitioning graphs, Tech. report SAND 93-1301, Sandia National Laboratories, Albuquerque, NM (1993)]. From the early work it was clear that multilevel techniques held great promise; however, it was not known if they can be made to consistently produce high quality partitions for graphs arising in a wide range of application domains. We investigate the effectiveness of many different choices for all three phases: coarsening, partition of the coarsest graph, and refinement. In particular, we present a new coarsening heuristic (called heavy-edge heuristic) for which the size of the partition of the coarse graph is within a small factor of the size of the final partition obtained after multilevel refinement. We also present a much faster variation of the Kernighan-Lin (KL) algorithm for refining during uncoarsening. We test our scheme on a large number of graphs arising in various domains including finite element methods, linear programming, VLSI, and transportation. Our experiments show that our scheme produces partitions that are consistently better than those produced by spectral partitioning schemes in substantially smaller time. Also, when our scheme is used to compute fill-reducing orderings for sparse matrices, it produces orderings that have substantially smaller fill than the widely used multiple minimum degree algorithm.

Reviewer: Reviewer (Berlin)

MSC:

68R10	Graph theory (including graph drawing) in computer science
05C85	Graph algorithms (graph-theoretic aspects)

Cited in **2** Reviews
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Keywords:

graph partitioning; parallel computations; fill-reducing orderings; finite element computations

Software:

Chaco; MESHPART

Full Text: DOI