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**Contraction and treewidth lower bounds.** (English) Zbl 1161.68644

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Summary: Edge contraction is shown to be a useful mechanism to improve lower bound heuristics for treewidth. A successful lower bound for treewidth is the degeneracy: the maximum over all subgraphs of the minimum degree. The degeneracy is polynomial time computable. We introduce the notion of contraction degeneracy: the maximum over all minors of the minimum degree. We show that the contraction degeneracy problem is NP-complete, even for bipartite graphs, but for fixed  $k$ , it is polynomial time decidable if a given graph  $G$  has contraction degeneracy at least  $k$ . Heuristics for computing the contraction degeneracy are proposed and evaluated. It is shown that these can lead in practice to considerable improvements of the lower bound for treewidth, but can perform arbitrarily bad on some examples. A study is also made for the combination of contraction with Lucena's lower bound based on Maximum Cardinality Search. Finally, heuristics for the treewidth are proposed and evaluated that combine contraction with a treewidth lower bound technique by *F. Clautiaux, J. Carlier, A. Moukrim* and *S. Négre* [*Lect. Notes Comput. Sci.* 2647, 70-80 (2003; [Zbl 1023.68645](#))].

**MSC:**

**68R10** Graph theory (including graph drawing) in computer science

Cited in **18** Documents

**Keywords:**

[edge contraction](#); [contraction degeneracy](#); [bipartite graphs](#)

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