Computing Set Upper Tolerance for the Minimal Spanning Tree Problem

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This is joint work with Gerold Jäger

Sensitivity analysis in combinatorial optimization examines how changes in the costs of elements affect the optimality of solutions. In this work, we focus on the concept of upper tolerance. In particular, the *single upper tolerance* gives how much the cost of a given element can be increased while ensuring that all current optimal solutions remain optimal and the *set upper tolerance* gives how much the sum of the costs of the elements of a given set can be increased while still maintaining optimality of all current solutions [**?**].

In this work, we study upper tolerances for the *Minimum Spanning Tree Problem* (MSTP), which seeks a minimum-weight spanning tree in a weighted undirected graph. While efficient algorithms for computing single upper tolerances for the MSTP are well known (see, e.g., [**?**, **?**]), set upper tolerances for this problem have not been previously investigated, to the best of our knowledge.

We present two polynomial-time algorithms for computing set upper tolerances for the MSTP. Whereas the first algorithm is based on a linear programming formulation, the second one is a purely combinatorial algorithm independent of linear programming. We investigate the complexities of both algorithms and compare them also experimentally. Finally, we discuss possible directions for improving the efficiency of the combinatorial algorithm.

References

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