Generalized Metric Inequalities for Robust Network Design

G. Claßen[1], A. C. A. Koster[2], M. Kutschka[3], and I. Tahiri[4]

Abstract: Classical Network Design of telecommunication networks determines a cost-minimal link capacity installment and a static routing scheme such that the traffic given by a single fixed traffic matrix can be routed without exceeding the link capacities.

Robust Network Design generalizes this concept by taking traffic fluctations into account. Here, the traffic demands are not given by a single fixed traffic matrix but by an uncertainty set on the traffic volumes. In 2003, Bertsimas and Sim [1] have introduced the concept of Γ-robustness offering an adjustable polyhedral uncertainty set. Koster et al. [2] have applied this approach to Classical Network Design resulting in the Γ-Robust Network Design.

The (Γ-Robust) Network Design Problem can be solved using a branch-and-cut approach. To speed-up the solving process several classes of valid inequalities are known, e. g., (robust) cutset inequalities. In classical Network Design the so-called metric inequalities generalize the cutset inequalities. Moreover, by projecting out the flow variables the classical Network Design Problem can be reformulated using metric inequalities only.

In this talk, we generalize the metric inequalities for Classical Network Design to robust metric inequalities for Γ-Robust Network Design. We also give a reformulation of the Γ-Robust Network Design Problem by robust metric inequalities only. Further, we present a polynomial exact separation algorithm for robust metric inequalities. In a computational study, we compare the effectiveness of this class of inequalities with robust cutset inequalities.

References

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[1,2,3] Lehrstuhl II für Mathematik
RWTH Aachen University
Wüllnerstraße 5b, D-52056 Aachen, Germany
{*classen,koster,kutschka*}*@math2.rwth-aachen.de*

[4] INRIA
2004, route des Lucioles, B.P. 93, F-06902 Sophia Antipolis Cedex, France
issam.tahiri@inria.fr