Scientific Report

STSM on Mathematical Optimization in the decision support systems for Efficient and Robust Energy Networks

March 6, 2014

A short-term scientific mission[1] has been carried out by Daniel Schmidt, University of Cologne, at the University of Bologna from the 16th to the 21st of February 2014. The research was done together with Prof. Dr. Andrea Lodi and Dr. Valentina Cacchiani.

Purpose of the STSM

In an ongoing cooperation on a robust network design problem, we had already developed a working branch-and-cut algorithm and aimed to produce final results. The purpose of the mission was to complete the final development stage of the algorithm and to prepare it for publication. To this end, we wanted to ensure that the algorithm can compete with commercial solvers.

Work carried out on the STSM

We evaluated the performance of the algorithm for both finite and polyhedral uncertainty sets. The evaluation was carried out on a testbed of four different instance classes per uncertainty notion with a total number of considered problem instances that amounts to approximately 40,000. In a parameter tuning, we explored three different strategies of traversing the branch-and-bound tree.

Due to the large amount of data generated by the experiments, automatic charting of the results was required. We built command line tools to deal with this task for each uncertainty notion and each instance class.

---

[1]COST reference ECOST-STSM-TD1207-160214-041151

Finally, we prepared the experimental results for publications and discussed their interpretation in length. Again to prepare publication, we worked on a concise description of the algorithm.

Description of the main results

We were able to establish by our experiments that our algorithm is able to compete with commercial MIP solvers. With the help of our command line tools, we developed a concise presentation of our experiments that is fit for publication. Together with our mutually developped description of the algorithm, this enabled us to complete major parts of the intended publication.

Due to our joint efforts during the STSM, we were able to submit our work to the *Mathematical Programming* journal on the 1st of March.

Future collaboration and foreseen publications

The work carried out during the STSM marked the end of a middle-term collaboration. Due to the success of the project, however, future collaborations can certainly be envisaged. As described in the previous paragraph, we hope to publish our work in the *Mathematical Programming* journal.

Confirmation by the host institution of the successful execution of the STSM

See the attached document.