EDITORIAL

2021 MMOR best paper award

Oliver Stein[1]

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In 2021 we published 33 papers online in MMOR. It is my great pleasure to announce that the 2021 MMOR Best Paper Award has been bestowed on the paper

> ***A bilevel optimization approach to decide the feasibility of bookings in the European gas market***
>
> by *Fränk Plein*, *Johannes Thürauf*, *Martine Labbé* and *Martin Schmidt*
> published online September 23, 2021.

Abstract: The European gas market is organized as a so-called entry-exit system with the main goal to decouple transport and trading. To this end, gas traders and the transmission system operator (TSO) sign so-called booking contracts that grant capacity rights to traders to inject or withdraw gas at certain nodes up to this capacity. On a day-ahead basis, traders then nominate the actual amount of gas within the previously booked capacities. By signing a booking contract, the TSO guarantees that all nominations within the booking bounds can be transported through the network. This results in a highly challenging mathematical problem. Using potential-based flows to model stationary gas physics, feasible bookings on passive networks, i.e., networks without controllable elements, have been characterized in the recent literature. In this paper, we consider networks with linearly modeled active elements such as compressors or control valves. Since these active elements allow the TSO to control the gas flow, the single-level approaches for passive networks from the literature are no longer applicable. We thus present a bilevel model to decide the feasibility of bookings in networks with active elements. While this model is well-defined for general active networks, we focus on the class of networks for which active elements do not lie on cycles. This assumption allows us to reformulate the original bilevel model such that the lower-level problem is linear for every given upper-level decision. Consequently, we derive several single-level reformulations for this case. Besides the classic Karush–

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Kuhn–Tucker reformulation, we obtain three problem-specific optimal-value-function reformulations. The latter also lead to novel characterizations of feasible bookings in networks with active elements that do not lie on cycles. We compare the performance of our methods by a case study based on data from the GasLib.

Fränk Plein studied Mathematics at Université Libre de Bruxelles (ULB), where he obtained his Master's degree in 2017. From 2017 to 2021, he was a doctoral researcher jointly between ULB and Trier University. His research was focused on feasibility problems in European gas networks as well as specific aspects of linear bilevel optimization. He obtained his joint PhD degree from both universities in June 2021. Since then he is working as a Software Engineer at Sedai Luxembourg, where he develops quantitative trading solutions.

Johannes Thürauf is a postdoctoral researcher at the University of Trier. He studied Mathematics at the Friedrich-Alexander Universität (FAU) Erlangen–Nürnberg and received his MSc degree in 05/2017. Afterward, he worked as a PhD student at the FAU Erlangen–Nürnberg and got his PhD at the end of 2021. His research topics include optimization under uncertainty, network optimization with a focus on energy networks, as well as combinatorial and algorithmic optimization.

Martine Labbé is honorary professor at the Université Libre de Bruxelles (ULB). Her main research area is discrete optimization, including graph theory and integer optimization problems and with a particular emphasis on location and network design problems. She is also specialised in bilevel optimization and studies pricing problems and Stackelberg games. She is the author or coauthor of more than 120 papers published in international journals. She was president of EURO, the Association of European Operational Research Societies, in 2007–2008 and Vice-Chair of the SIAM Activity Group on Optimization (SIAG/OPT) in 2014–2015. In 2019 she was awarded the EURO Gold Medal.

Martin Schmidt studied Mathematics and Computer Science at the Leibniz Universität Hannover and received his PhD in 2013 in the area of algorithmic optimization. From 2014 to 2018 he was junior professor for the optimization of energy systems at the Friedrich–Alexander–Universität Erlangen–Nürnberg and the Energy Campus Nürnberg, before he moved to Trier University. His research interests are mixed-integer nonlinear as well as bilevel optimization.

Congratulations to the four authors in the name of the MMOR editorial board !

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