MIP Insights

The newsletter of the Mixed-Integer Programming Society

The Mixed-Integer Programming Society

In 2022, the Mixed-Integer Programming Society (MIPS) was established as a technical section of the Mathematical Optimization Society. The goal of MIPS is to serve as a catalyst for the community of researchers working in Mixed-Integer Programming and its applications, both inside and outside academia, and promote the continuity of events of interest for the community. In particular, it supports the organization of the annual MIP workshop and of the online Discrete Optimization Talks, and promotes the dissemination of results in the area. For more information, check the website www.mixedinteger.org.

Why this newsletter?

This newsletter will be used to announce important news for the community, promote events supported by the society, and provide reports on recently concluded activities. We also plan to host expository presentations of relevant results in the area.

COMIPS elections and roles

The COMIPS is the board of the Mixed-Integer Programming Society. In Fall 2022, elections were held for three at-large members of COMIPS. Out of 15 candidates, Akshay Gupte (University of Edinburgh, UK), Joseph Paat (University of British Columbia, Canada), and Stefan Weltge (Technical University of Munich, Germany) were elected. They joined Yuri Faenza (Columbia University, USA), Carla Michini (University of Wisconsin-Madison, USA), and Yuan Zhou (University of Kentucky, USA), who are ex officio COMIPS members as chairs of the program committees of the last two Mixed-Integer Programming Workshops. In January 2023, the COMIPS elected Yuri Faenza as its Chair, Joseph Paat as its Secretary, Akshay Gupte as its Treasurer, and Stefan Weltge as its Webmaster. They will hold office until June 2024.

The 2022 MIP Workshop

After two years of online meetings because of the COVID-19 pandemic, the 19th edition of the Mixed-Integer Programming (MIP) Workshop was held at DIMACS, Rutgers University (USA), on May 23-26, 2022. It featured *DANniversary*, a special one-day event celebrating Daniel Bienstock's contributions to the community and to research in the area. Over the four days of the workshop, presenters gave 27 talks in front of 135 participants, with topics ranging from the theory of integer and convex programming, to combinatorial optimization, applications, and computational experiments. See https://www.mixedinteger.org/2022/ for a list of talks, presenters, pictures, and sponsors.

Computational competition

The 2022 edition of the MIP Workshop saw the annual event's first-ever computational competition. The main objective behind this competition is to encourage and provide recognition to such an important component of the MIP community: the development of computational tools.

In this edition of the competition, participants were challenged to create novel general-purpose primal heuristics for mixed-integer linear optimization problems. The winner of the competition and the runner up were invited to submit an article with their findings to *Mathematical Programming Computation* and offered an expedited review process.

Winner: *Feasibility Jump: an LP-free Lagrangian MIP heuristic* by Bjørnar Luteberget and Giorgio Sartor (SINTEF, Norway). Feasibility Jump (FJ) is a general-purpose pre-root primal heuristic for mixed-integer linear programming (MILP) problems. The idea is to consider the Lagrangian relaxation of a MILP problem where we relax all but the integrality constraints. Then, starting from an existing (possibly infeasible) assignment, FJ iteratively updates the value of the single variable that most reduces the total violation of the linear constraints. Whenever a local minimum is reached, the Lagrangian multipliers are modified by increasing the weights of the remaining unsatisfied constraints. Feasibility Jump has shown to be effective on many difficult problems from MIPLIB 2017.

Second Place: *A fix-propagate-repair heuristic for Mixed-Integer Programming* by Domenico Salvagnin, Roberto Roberti, and Matteo Fischetti (University of Padua, Italy). This approach is an extension of the common fix-and-propagate scheme, with the addition of solution repairing after each step: the repair logic is loosely based on the WalkSAT strategy for boolean satisfiability. Different strategies for variable ranking and value selection, as well as other options, yield different diving heuristics. A portfolio approach of strategies proved to be quite effective, consistently finding feasible solutions in 189 out of 240 instances from MIPLIB 2017, in a matter of a few seconds of runtime.

Student poster session

29 students presented their works in the poster session. The Poster Award committee, in the persons of Samuel Fiorini (University of Brussels, Belgium), Jon Lee (University of Michigan, USA – chair), Vera Traub (ETH Zurich, Switzerland), Juan Pablo Vielma (Google Research, USA), and Yiling Zhang (University of Minnesota, USA) selected the work *Small shadows of lattice polytopes* by Alex Black (University of California-Davis, USA) for the Best Poster Award. Honorable Mentions were given to the following posters: *Reusing combinatorial structure: faster iterative projections over submodular base polytopes* by Jai Moondra and Hassan Mortagy (Georgia Tech, USA); *On constrained mixed-integer DR-submodular minimization* by Qimeng Yu (Northwestern University, USA); *An SDP relaxation for the sparse integer least square problem* by Dekun Zhou (University of Wisconsin-Madison, USA). Anna Deza (University of California, Berkeley, USA) won the most popular poster award (as voted by the workshop participants) for her work *Screening for logistic regression with* $\ell_0 - \ell_2$ *regularization*.

The 2023 MIP Workshop

The 2023 Mixed-Integer Programming Workshop will be held on May 22-25 at the University of Southern California. The workshop will cover a wide array of topics, including theory of integer programming, combinatorial optimization, and applications, presented by 22 experts from around the world.

In addition to the invited presentations, the workshop will host two competitions: a poster competition and the second annual computational competition. The poster competition is dedicated to exhibiting the work of current PhD students. Selected from a large competitive pool of applicants, 30 posters will be presented in person at the conference and compete for the workshop's best poster award. For the computational competition, the topic of its second edition is *MIP Reoptimization*, where participants were asked to design methods for reusing information from one MIP to solve a similar one. High-quality submissions to the computational competition will receive an expedited review process in *Mathematical Programming Computation*.

As the cherry on top, this workshop edition will be the 20th in the MIP series. To celebrate the occasion, there will be a special contribution from some of the first organizers of the MIP series, who are still highly active members of our community. See https://www.mixedinteger.org/2023/ for a list of talks, presenters, and registration instructions.

See you in Los Angeles!

Discrete Optimization Talks (DOTs)

Discrete Optimization Talks, or DOTs, is a virtual seminar series initiated by Aleksandr M. Kazachkov (University of Florida, USA) and Elias B. Khalil, (University of Toronto, Canada) on theoretical, computational, and applied aspects of integer and combinatorial optimization. DOTs emerged in April 2020 as a way for the field to stay connected during the COVID-19 pandemic.

The format of DOTs is two half-hour talks in each session, followed by a special social component, which distinguishes it from other seminars. DOTs opens breakout rooms to ask speakers questions in a small-group setting or to just casually socialize with participants. There have been over sixty DOTs to date from speakers in North America, South America, Europe, and Australia, across academia and industry, with emphasis on early-career researchers.

If you are interested in giving a DOT, submit your talk here. Find more information about DOTs here, including links to previous talks and to join the mailing list. You can find DOTs posts on Twitter under the hashtag *#DiscreteOptTalks*.

We hope you join us for the next DOTs on April 28 at 12pm ET.

Text by Yuri Faenza, Aleksandr M. Kazachkov, Gonzalo Muñoz, Joseph Paat, Domenico Salvagnin, and Giorgio Sartor.