MIP Insights

The newsletter of the Mixed Integer Programming Society

Table of contents

MIP International 2024 MIP Workshop

MIP International 2024 was the inaugural international edition of the workshop since its inception in 2003. The workshop was hosted by IIT Bombay, India from December 2 through December 6, 2024. The workshop brought together the global MIP community at IITB. In particular, participants traveled from 15 different countries covering all but one continent. With poster sessions for students and insightful talks by leading experts in the area, it was an enriching experience for the students in particular, and everyone involved at large. In the poster competition, Prachi Shah's work on "Improving Strong-Branching With Additional Information" was awarded the best poster award, with honorable mentions of Akul Bansal and Shreyas Bhowmik's work. Recordings of the talks are available on the MIPS Youtube channel.

The 2025 MIP Workshop

Registration is open for the 2025 Mixed Integer Programming Workshop and Summer School, which will be held June 2–6, 2025 at the University of Minnesota. This will be the twenty-second edition of the series, returning to Minneapolis twenty years after the second MIP workshop. MIP 2025 will continue many of the essential traditions that have made this annual workshop a gathering place for the community, and we invite you to join us and participate in

- a single track of 19 invited experts across theoretical, computational, and applied aspects of integer programming and discrete optimization.
- a poster session, including a competition among selected student finalists for the best poster award, held jointly with a welcome reception.
- a computational competition on "Primal Heuristics for MIQCQP".
- a summer school with three invited speakers.
- a session of contributed "flash" talks.

Also, please note that the annual business meeting of the Mixed Integer Programming Society (MIPS) will be held in a hybrid format this year. If you would like to attend via Zoom, then please use the following login information:

Topic:	MIPS Business Meeting at MIP 2025
Time:	Jun 5, 2025 16:15 Central Time (US and Canada)
Meeting ID:	931 8366 2178
Passcode:	MIP

If you have any questions, please email Aleksandr Kazachkov at akazachkov@ufl.edu. We hope to see you in Minneapolis!

Program Committee: Sophie Huiberts, Aleksandr Kazachkov, Sebastian Perez-Salazar, Christian Tjandraatmadja, Yiling Zhang

Local Committee: Jean-Philippe Richard, Saumya Sinha, Yiling Zhang

MIP European Workshop 2025

The MIP International Workshop Series is coming to Europe. On July 1-3, 2025 we will meet for a three-day workshop in Clermont-Ferrand, France. This will be a single-track workshop with invited talks and a poster session.

Registration is open until June 1, 2025, on the website. Student travel support is available in the form of free accommodation.

Organizing Committee: Rafael Colares, Renaud Chicoisne, Sophie Huiberts Program Committee: Mathieu Besançon, Alexander Black, Claudia D'Ambrosio, Christopher Hojny, Sophie Huiberts

MIP South America 2025

We are excited to announce the Mixed Integer Programming Workshop South America, which will take place December 9 - 12, 2025, at Universidad Adolfo Ibáñez in Viña del Mar, Chile. MIP South America is part of the MIP International Workshop series, which is held in addition to the classical MIP Workshop. This will be the first time a MIP event is held in South American exciting milestone for the community!

The workshop will follow the traditional MIP single-track format of invited talks that showcase the latest advances in integer programming and discrete optimization. The speaker lineup will feature prominent researchers from academia and industry across a wide range of fields and career stages. The program will also include a poster session, which is currently open for submissions.

For the full list of speakers, poster submission form, and more information, visit the website. We look forward to seeing you in Chile!

Program Committee: Victor Bucarey, Margarida Carvalho, Andrés Gómez, Javier Marenco, Gonzalo Muñoz, Eduardo Uchoa

Local Committee: Victor Bucarey, Rodolfo Carvajal, Gonzalo Muñoz

Welcome new members of COMIPS

The Committee Mixed Integer Programming Society (COMIPS) is the governing board of the Mixed Integer Programming Society. The duties of COMIPS include ensuring the continuity of the MIP Workshop, approving the new MIP organizing committee, and auditing its financial reports.

COMIPS consists of three elected officials plus the chairs of the last two MIP organizing committees. The MIP 2024 and 2025 chairs are Joseph Paat (University of British Columbia, Canada) and Aleksandr Kazachkov (University of Florida, USA), respectively. In March 2025, elections were held for the remaining three COMIPS positions. Congratulations to the following individuals, who will be joining Aleks and Joseph on COMIPS:

- Silvia Di Gregorio (Université Sorbonne Paris Nord, France)
- Christopher Hojny (Eindhoven University of Technology, Netherlands)
- Weijun Xie (Georgia Institute of Technology, USA)

Thank you to Silvia, Christopher, and Weijun for willing to serve on COMIPS! We would also like to thank current COMIPS members – Akshay Gupte, Gonzalo Muñoz, and Stefan Weltge – whose tenure on COMIPS ends in 2025. We appreciate all of the effort you have made to help MIPS grow!

Discrete Optimization Talks (DOTs)

The Mixed Integer Programming Society supports Discrete Optimization Talks (DOTs), a virtual seminar series on all aspects of integer and combinatorial optimization. A typical DOTs session features two half-hour talks followed by breakout rooms to facilitate small-group interactions. Thank you to all the speakers and participants of DOTs this season. We are excited to be updating the organizational team later this year. Stay tuned!

To receive updates about upcoming DOTs, please join the mailing list. Past talks and more information can be found on our website. If you are interested in giving a DOT, please submit a proposal. We look forward to seeing you!

New books on MIP topics

Recently, members of the discrete optimization community have written new books covering a variety of topics. Here, we summarize some of these books and highlight some of the content. All of these were published by Cambridge University Press.

These summaries were collected by Akshay Gupte.

1. **Title:** Convexity and its applications in discrete and continuous optimization

   Author: Amitabh Basu

   Using a pedagogical, unified approach, this book presents both the analytic and combinatorial aspects of convexity and its applications in optimization. On the structural side, this is done via an exposition of classical convex analysis and geometry, along with polyhedral theory and geometry of numbers. On the algorithmic/optimization side, this is done by the first ever exposition of the theory of general mixed-integer convex optimization in a textbook setting. Classical continuous convex optimization and pure integer convex optimization are presented as special cases, without compromising on the depth of either of these areas. For this purpose, several new developments from the past decade are presented for the first time outside technical research articles: discrete Helly numbers, new insights into sublinear functions, and best known bounds on the information and algorithmic complexity of mixed-integer convex optimization. Pedagogical explanations and more than 300 exercises make this book ideal for students and researchers.

   This book

   - Introduces both the analytic and combinatorial aspects of convexity in a unified setting, treating the completely continuous and purely discrete settings as special cases without compromising on the depth of either one.
   - Presents easy-to-follow, pedagogical exposition of recent developments in convex analysis and mixed-integer convex optimization, including discrete Helly numbers, new insights into sublinear functions, and best known bounds on the information and algorithmic complexity of mixed-integer convex optimization.
   - Includes more than 300 exercises that reinforce conceptual understanding and improve technical skills in structural and algorithmic arguments.

2. **Title:** Primal heuristics in integer programming

   Authors: Timo Berthold, Andrea Lodi, Domenico Salvagnin

   Primal heuristics guarantee that feasible, high-quality solutions are provided at an early stage of the solving process, and thus are essential to the success of mixed-integer programming (MIP). By helping prove optimality faster, they allow MIP technology to extend to a wide variety of applications in discrete optimization. This first comprehensive guide to the development and use of primal heuristics within MIP technology and solvers is ideal for computational mathematics graduate students and industry practitioners. Through a unified viewpoint, it gives a unique perspective on how state-of-the-art results are integrated within the branch-and-bound approach at the core of the MIP technology. It accomplishes this by highlighting all the required knowledge needed to push the heuristic side of MIP solvers to their limit and pointing out what is left to do to improve them, thus presenting heuristic approaches for MIP as part of the MIP solving process.

   This book

   - Presents heuristic approaches as part of the MIP solving process, helping readers build a cohesive understanding of how primal heuristics interact with the MIP solution scheme
   - Tackles practical concerns by examining trade-offs between efficiently providing feasible solutions and assuring high quality
   - Shows how published results are integrated within the branch-and-bound approach at the core of MIP technology

3. **Title:** Approximation algorithms for traveling salesman problems

   Authors: Vera Traub and Jens Vygen

   The Traveling Salesman Problem (TSP) is a central topic in discrete mathematics and theoretical computer science. It has been one of the driving forces in combinatorial optimization. The design and analysis of better and better approximation algorithms for the TSP has proved challenging but very fruitful. This is the first book on approximation algorithms for the TSP, featuring a comprehensive collection of all major results and an overview of the most intriguing open problems. Many of the presented results have been discovered only recently, and some are published here for the first time, including better approximation algorithms for the asymmetric TSP and its path version. This book constitutes and advances the state of the art and makes it accessible to a wider audience. Featuring detailed proofs, over 170 exercises, and 100 color figures, this book is an excellent resource for teaching, self-study, and further research.

   This book

   - Serves as a self-contained resource on approximation algorithms for the Traveling Salesman Problem, covering all major results and putting recent developments into context
   - Serves as a starting point for future research with several of the authors' previously unpublished results
   - Guides students and self-learners through the field through pedagogical explanations, detailed proofs, and many exercises and color figures.

An invitation to submit to INFORMS Journal On Optimization

by Oktay Günlük

Dear fellow optimizers,

The INFORMS Journal on Optimization (IJOO) has recently broadened its focus to welcome papers from all aspects of mathematical optimization, including theory, algorithms, software, computation, and the connections between these areas. The journal also invites submissions that explore significant and novel applications of optimization. We encourage contributions at the intersection of optimization and machine learning, particularly those relevant to decision-making.

IJOO welcomes papers that have appeared previously in conference proceedings, provided they meet the journal's standards. We also invite proposals for special issues on topics of current interest to the optimization community; each special issue will be managed by one or more guest editors.

On behalf of the editorial board of IJOO, we look forward to your contributions!

The current editorial board includes Guzin Bayraksan (Ohio State), Frank E. Curtis (Lehigh), Sanjeeb Dash (IBM Research), Oktay Gunluk (Georgia Tech), Giacomo Nannicini (USC), Courtney Paquette (McGill), Mohit Singh (Georgia Tech), and Nick Sahinidis (Georgia Tech).

Oktay Günlük, Editor-in-Chief

The ACOPF Problem – try it if you dare[1]

by Daniel Bienstock (Columbia University)

Introduction

The Alternating-Current Optimal Power Flow (ACOPF) problem is a challenging and compelling problem arising in the operation of power grids. Lest our methodologically-minded colleagues roll their eyes at an application, let me point out that this problem is one that all of us would benefit from understanding. Its study encompasses a number of appealing features: it involves many areas of optimization (linear, convex, nonlinear, global and integer optimization); it is a realistic problem for which we have a large amount of realistic datasets, ranging from very small to very large; it is very well documented and supported by a large community of strong researchers; and, last but not least, ACOPF instances strain all of our solvers. The problem is also of vital importance in the daily operation of power grids –currently, simplifications, approximations and relaxations of ACOPF are run, on a daily basis, and they constitute the backbone of the intelligence underlying power grids. As ACOPF capabilities (rapidly) improve, we can anticipate a forthcoming day where full ACOPF is run, instead of simplifications – it is notable that the power engineering community views that capability as critical, in light of increasingly demanding grid operations and economics. Finally, the underlying mathematics touches on fundamental and cutting-edge topics ranging from semidefinite optimization to algebraic geometry.

Here we will provide a very high-level and brief outline of the state of the art; please see the references therein. A good resource is the survey [16]. Also see [4], [7]. We also invite the readers to explore the power engineering perspective; see the excellent textbooks [2] and [11] which include extensive discussion on optimization details and how they arise. Finally, our recent paper [6] (joint with my PhD student Matías Villagra) contains an extensive list of references.

Basic description

The standard, single-period ACOPF problem is as follows: we are given a network where some nodes have *load* (i.e., demand for power) and some nodes house generators. The goal is to generate power at minimum cost so as to satisfy the demands, with power flowing according to laws of physics. The latter is accomplished using complex variables to represent *voltages* and using a bilinear representation of (complex) power flows. In equation form (notation below):

$$\text{[ACOPF]}: \qquad \min \sum_{k\in\mathcal{G}} F_k(P_k^g) \tag{1a}$$

subject to: $\forall$ branch $\{k,m\} \in \mathcal{E}$:

$$P_{km} = G_{kk}|V_k|^2 + |V_k||V_m|(G_{km}\cos(\theta_k-\theta_m) + B_{km}\sin(\theta_k-\theta_m)) \tag{1b}$$

$$P_{mk} = G_{mm}|V_m|^2 + |V_k||V_m|(G_{mk}\cos(\theta_k-\theta_m) - B_{mk}\sin(\theta_k-\theta_m)) \tag{1c}$$

$$Q_{km} = -B_{kk}|V_k|^2 - |V_k||V_m|(B_{km}\cos(\theta_k-\theta_m) - G_{km}\sin(\theta_k-\theta_m)) \tag{1d}$$

$$Q_{mk} = -B_{mm}|V_m|^2 - |V_k||V_m|(B_{mk}\cos(\theta_k-\theta_m) + G_{mk}\sin(\theta_k-\theta_m)) \tag{1e}$$

$$\sum_{\{k,m\}\in\delta(k)} P_{km} = \sum_{\ell\in\mathcal{G}_k} P_\ell^g - P_k^d \quad \forall \text{ bus } k\in\mathcal{B} \tag{1f}$$

$$\sum_{\{k,m\}\in\delta(k)} Q_{km} = \sum_{\ell\in\mathcal{G}_k} Q_\ell^g - Q_k^d \quad \forall \text{ bus } k\in\mathcal{B} \tag{1g}$$

$$(V_k^{\min})^2 \le |V_k|^2 \le (V_k^{\max})^2 \quad \forall \text{ bus } k\in\mathcal{B} \tag{1h}$$

$$\max\left\{P_{km}^2 + Q_{km}^2, P_{mk}^2 + Q_{mk}^2\right\} \le U_{km} \quad \forall \text{ branch } \{k,m\}\in\mathcal{E} \tag{1i}$$

$$P_k^{\min} \le P_k^g \le P_k^{\max} \quad \forall \text{ generator } k\in\mathcal{G} \tag{1j}$$

$$Q_k^{\min} \le Q_k^g \le Q_k^{\max} \quad \forall \text{ generator } k\in\mathcal{G} \tag{1k}$$

In this formulation, $\mathcal{N} := (\mathcal{B},\mathcal{E})$ is a network where $\mathcal{B}$ denotes the set of nodes (or *buses* in power engineering parlance), and $\mathcal{E}$ denotes the set of edges (*branches*). We denote by $\mathcal{G}$ the set of generators of the grid, each of which is located at some bus; for each bus $k \in \mathcal{B}$, we denote by $\mathcal{G}_k \subseteq \mathcal{G}$ the generators at bus k. The *variables* in the above problem are: for each bus k its voltage magnitude $|V_k|$ and phase angle θ_k, and for each generator k, its output given by P_k^g and Q_k^g. All other parameters above are data inputs to the problem. The cost functions F_k are convex; specifically, convex quadratics in the data sets that are publicly available. In industrial practice they are convex piecewise-linear, reflecting *bids* from generator operators to energy markets.

We refer the reader to the textbook citations for background on this formulation.

Scale of problem

ACOPF problems involve networks that are quite sparse but can be very large. The number of variables scales linearly with the number of nodes but the multiple is nontrivial (say, eight times the number of nodes) and likewise with the number of constraints. As an example, 1354pegase has over 60,000 variables and 72,000 constraints, while a much larger instance such as ACTIVSg70k has over 3.1 million variables and 3.3 million constraints. Their multiperiod variants are, of course, significantly larger: the number of periods is the multiplier to be used to scale the variable and constraint counts, and that number may be as large as 24 or, even, 48.

Such numbers are somewhat daunting. These problems, and their convex relaxations, strain the capabilities of all solvers. See [6] for extensive experiments that support this view. An additional hazard arises from numerical difficulties – discussed below.

What works: computing feasible solutions.

The current dominant industry perspective is that computing good feasible solutions is of primary importance. In this domain, there is a clearly dominant technology: local solvers, i.e., interior point methods. Knitro [8] and IPOPT [18] are outstanding examples – every optimizer should understand their respective methodologies, which are closely related but differ in some critical elements. One should note (a point taken up in the next section) that ACOPF can be equivalently reformulated as a QCQP, and, in principle, any QCQP solver (which will rely on spatial branch-and-bound as well as other techniques) could, in principle, be deployed. However, the empirical experience at this point is that the local solvers are overwhelmingly superior. We invite readers to peruse the performance tables in [6]. We are primarily familiar with Knitro, and we have been able to compute solutions to *all* single-period problems that are publicly available, in quite reasonable time.

There is inadequate space in this article to describe the methodology incorporated in Knitro or IPOPT; indeed, it is supported by a very strong literature – one that all optimizers should familiar with. In short, given a nonlinear optimization problem, it is nominally replaced by its *barrier* version. "Solving" that problem and allowing the barrier parameter to converge to zero would, ideally, yield the desired outcome. We use quotes because we are referring to nonconvex problems here. Instead we should say that we are computing a critical point for the barrier function. And that goal is tackled by writing the KKT conditions (for the barrier problem) – again, there is a leap of faith here because it is not clear that KKT multipliers will exist. At any rate, one could then solve for the KKT conditions using Newton's algorithm. Here, the solvers do something clever: at each Newton iteration, rather than take a Newton step, a line search is performed. And, if in the course of the line search, a better solution *to the original problem (not the barrier problem)* the algorithm will avoid being pedantic and, instead, attempt to move to that solution. Or, if in the course of the Newton algorithm, convergence to an inferior solution is detected, then steps are taken to prevent such steps in the future.

We refer the readers to [8] and [18] for precise mathematical statements. In any case, local solvers dominate the ACOPF landscape. Of course, their performance comes at the cost of complete lack of guarantee as to the quality of the computed solution – even, feasibility. Moreover, roundoff error can be significant. Here we are touching on a touchy issue: what is the relationship between numerical infeasibility and superoptimality in the case of nonlinear problems; especially in the nonconvex case?

Convex relaxations – and why do we care? And do they work – why or why not?

My co-conspirators of the integer programming persuasion would loudly argue that *of course* it is vitally important to develop tight convex relaxations, so as to certify the quality of solutions produced by local solvers. That is certainly a worthwhile goal from a research perspective – but do our industry counterparts actually care?

Let us defer, or rather, avoid this pesky question, and instead temporize by remarking that convex relaxations must be speedy, reliable and accurate in order to be actually useful. And there is much work to be done in this regard – in our experience, nonlinear convex solvers struggle with convex relaxations (which we detail next) for ACOPF. There is work to be done.

[1] This work was supported by an ARPA-E GO award

However, there *is* a compelling, practical reason for the use of convex relaxations. Power grids around the world perform daily operations by running so-called *Energy Markets*. This term is to be taken with some latitude. At any rate, an essential function of power grids is that of payments: from entities representing consumers to those that operate generators. A central piece in this mechanism is the computation of ideally accurate marginal prices. Such prices can be obtained, in principle, from convex relaxations (especially when linear) but are very difficult to get from local solvers, if at all. We cannot overstate the importance of the pricing capability – it is indeed central in the operation of power delivery.

There is a very abundant literature addressing convex relaxations to ACOPF. See [16], [13], [14], [9], [3], [15], [5], [1], [10], [17]. Most of these relaxations rely on a common idea; a very effective way to obtain a (very) tight convex relaxation to ACOPF, which is due to Jabr [12]. Consider constraint (1b), repeated here for convenience:

$$P_{km} = G_{kk}|V_k|^2 + |V_k||V_m|(G_{km}\cos(\theta_k - \theta_m) + B_{km}\sin(\theta_k - \theta_m))$$

Suppose we introduce new variables $v_k^{(2)}$, c_{km} and s_{km} representing, respectively, $|V_k|^2$, $|V_k||V_m|\cos(\theta_k - \theta_m)$ and $|V_k||V_m|\sin(\theta_k - \theta_m))$. Using these variables, (1b) becomes the linear expression

$$P_{km} = G_{kk}v_k^{(2)} + G_{km}c_{km} + B_{km}s_{km},$$

and a similar linearization applies to all other nonconvex constraints in ACOPF! We now have a convex relaxation, but there is more: note that

$$c_{km}^2 + s_{km}^2 \ = \ v_k^{(2)}v_m^{(2)},$$

which is nonconvex, but can be relaxed to the SOC constraint

$$c_{km}^2 + s_{km}^2 \ \leq \ v_k^{(2)}v_m^{(2)}.$$

This is the well-known Jabr inequality, and extensive numerical computation the SOC formulation using it (and the linearizations described a few lines above), yields a very strong relaxation to all ACOPF instances.

In [6] we provide theoretical justification for this fact, outlined below. Moreover, we also perform experiments where a random, but small subset of Jabr inequalities are removed from the SOC relaxation – the result is, almost always, a drastic worsening of the relaxation. Why? Please read the following section.

We need to pause, however, because computational experiments performed by many authors show that these SOC relaxations are actually very challenging for all solvers. And why is that? Part of the reason lies in the explanation provided in the paragraph above: all, or almost all the Jabr inequalities will be tight at optimality. This fact alone seems to be a source of difficulty for the solvers, which takes us to the next topic.

Linear relaxations

Consider the variables P_{mk} and P_{km} in the ACOPF formulation given above. They describe, in power engineering language, the amount of ("active") power injected into branch $\{k, m\}$ at its two endpoints. One can argue mathematically, and also using basic physics, that in any feasible solution to ACOPF we must have $P_{mk} + P_{km} \geq 0$. Using this linear "loss inequality" instead of the Jabr inequality renders a linear model (in the space of the v^2, c, s variables), which, surprisingly, is quite tight [5].

Again, one might wonder why that is the case. In [6] we show that $P_{mk} + P_{km} \geq 0$ is a positive multiple of $v_k^2 + v_m^{(2)} - 2c_{km} \geq 0$, and, it turns out, this latter inequality is an outer-approximation to the Jabr inequality. Thus, enforcing Jabr implies the loss inequality, and, in turn that will provably imply a stronger relaxation bound than otherwise, because the alternative – i.e., negative losses – imply a form of free energy generation: each branch with a negative loss $L < 0$ acts as a zero cost generator producing $-L$ units of energy. Here, recall that the objective function for ACOPF is the cost of generation.

In [6] we perform extensive computational experiments using a robust algorithm for solving the Jabr relaxation (and the stronger and related $i2$-relaxation) using a cutting plane algorithm that relies on outer-approximation with a form of cut management combining rejection of new cuts that are too parallel to existing cuts, and removal of old cuts that have become slack. This methodology proves fast and robust – it scales well to multiperiod formulations even in the largest cases.

Best of all: the algorithm is warm-startable, a critical feature in the operation of real-time markets, where the solution of a problem is followed (after a short time) by that of a closely related problem. In our opinion this feature is a heavy selling point for the use of linear relaxations. Additionally, of course, we benefit from highly evolved LP solution methodologies.

What is next

In current research we are focusing on using our linear relaxations in the role of outer approximations to more evolved convex relaxations, i.e., beyond the Jabr and $i2$ formulations. A particularly enticing goal is that of producing good *feasible* solutions as a byproduct. Today, that goal is still proving elusive.

[1] M.S. Andersen, A. Hansson, and L. Vandenberghe. Reduced-Complexity Semidefinite Relaxations of Optimal Power Flow Problems. *IEEE Transactions on Power Systems*, 29:1855–1863, 2014.

[2] G. Andersson. *Modelling and Analysis of Electric Power Systems*. Power Systems Laboratory, ETH Zürich, 2004.

[3] X. Bai, H. Wei, K. Fujisawa, and Y. Wang. Semidefinite Programming for Optimal Power Flow problems. *International Journal of Electrical Power and Energy Systems*, 30:383–392, 2008.

[4] D. Bienstock. *Electrical Transmission System Cascades and Vulnerability, an Operations Research viewpoint*. Society for Industrial and Applied Mathematics, 2015.

[5] D. Bienstock and G. Munoz. On Linear Relaxations of OPF Problems. *arXiv:1411.1120*, pages 1–15, 2014.

[6] D. Bienstock and M. Villagra. Accurate and Warm-Startable Linear Cutting-Plane Relaxations for ACOPF. *Mathematical Programming C, to appear*, 2024.

[7] D. Bienstock, M. Escobar, C. Gentile, and L. Liberti. Mathematical Programming Formulations for the Alternating Current Optimal Power Flow problem. *4OR*, 18(3):249–292, 2020.

[8] R.H. Byrd, J. Nocedal, and R.A. Waltz. Knitro: An Integrated Package for Nonlinear Optimization. In *Large-Scale Nonlinear Optimization*, volume 83, pages 35–59. Springer, 2006.

[9] Carleton Coffrin, Hassan L. Hijazi, and Pascal Van Hentenryck. The qc relaxation: A theoretical and computational study on optimal power flow. *IEEE Transactions on Power Systems*, 31(4):3008–3018, 2016.

[10] A. Eltved, J. Dahl, and M.S. Andersen. On the Robustness and Scalability of Semidefinite Relaxation for Optimal Power Flow Problems. *Optimization and Engineering*, 21:375–392, 2020.

[11] J. D. GLover, M. S. Sarma, and T. J. Overbye. *Power System Analysis and Design*. CENGAGE Learning, 2012.

[12] R.A. Jabr. Radial distribution Load Flow using Conic programming. *IEEE Transactions on Power Systems*, 21(3):1458–1459, 2006.

[13] B. Kocuk, S.S. Dey, and X.A. Sun. Strong SOCP Relaxations for the Optimal Power Flow Problem. *Operations Research*, 64(6):1177–1196, 2016.

[14] B. Kocuk, S. S. Dey, and X. A. Sun. Matrix Minor Reformulation and SOCP-based Spatial Branch-and-Cut method for the AC Optimal Power Flow problem. *Mathematical Programming Computation*, 10(4):557–596, 2018.

[15] L. Lavaei and S. H. Low. Zero Duality Gap in Optimal Power Flow problem. *IEEE Transactions on Power Systems*, 27:92–107, 2012.

[16] D.K. Molzahn and I.A. Hiskens. A Survey of Relaxations and Approximations of the Power Flow Equations. *Foundations and Trends in Electric Energy Systems*, 4:1–221, 2019.

[17] J. Sliwak, Erling D. Andersen, M.F. Anjos, Létocart L., and E. Traversi. A Clique Merging Algorithm to Solve Semidefinite Relaxations of Optimal Power Flow Problems. *IEEE Transactions on Power Systems*, 36: 1641–1644, 2021.

[18] A. Wächter and L. T. Biegler. On the Implementation of a Primal-Dual Interior Point Filter Line Search Algorithm for Large-Scale Nonlinear Programming. *Mathematical Programming*, 106:25–57, 2006.

In 2022, the Mixed Integer Programming Society (MIPS) was established as a technical section of the Mathematical Optimization Society. In the MIP Insights *newsletter, we announce important news for the community, promote and summarize events supported by the society, and host expository presentations. Avinash Bhardwaj, Daniel Bienstock, Oktay Günlük, Akshay Gupte, Sophie Huiberts, Aleksandr M. Kazachkov, Gonzalo Muñoz, and Joseph Paat contributed to this issue.*