Optima@ISMP

Editorial

To help you to feel as comfortable as possible, we created a small Berlin guide book that you can find in your conference bags and as pdf and interactive map on the website. This compilation comprises a comprehensive yet incomplete list of nice restaurants, cafes, and bars. Well known addresses are contained as well as little urban gems that were recommended by our colleagues in the group of combinatorial optimization and graph algorithms at TU Berlin and at the Zuse Institute. Though our intention is not to replace a proper guide book but rather show you the corners of Berlin most tourists would usually miss, the Berlin guide also provides some basic information about practical issues as well as about the main sights of Berlin.

We hope that you will find our guide useful and wish you a successful conference and a pleasant stay in Berlin!

Wiebke Höhn and Max Klimm

Berlin-Mitte: Main Building of Humboldt-Universität zu Berlin, Unter den Linden 6 (Photo: Christoph Eyrich)

Today's Plenaries

- Yinyu Ye: *Recent Progresses in Linear Programming and the Simplex Method* (Tseng Memorial Lecture), 09.00–09.50, H 0105
- Rekha Thomas: *Lifts and factorizations of convex sets*, 17.00–17.50, H 0105 (attention: changed!)
- Teemu Pennanen: *Introduction to convex optimization in financial markets*, 17.00–17.50 h, H 0104

Plenary Talk of Robin Thomas Cancelled

We had been looking forward to Robin Thomas' plenary talk on *A new look at excluding a non-planar graph* – however, the talk has to be canceled because of the speaker's health problems. "A short summary is that I have been hospitalized on Tuesday with pneumonia", Robin Thomas told us on Sunday. "I was later advised that an international trip would be too risky. I was discharged on Friday, and am recuperating at home. I am feeling much better, but a full recovery is expected to take a couple of weeks." We all hope that Robin Thomas will recover and feel well again very soon!
His talk will be replaced by the Tseng Memorial Lecture.

The Tseng Memorial Lecture: Update

Yinyu Ye has changed the title of his Tseng Memorial Lecture; the new title is now *Recent Progresses in Linear Programming and the Simplex Method*.

Abstract: We prove that the classic policy-iteration method (Howard 1960), including the Simplex method (Dantzig 1947) with the most-negative-reduced-cost pivoting rule, is a strongly polynomial-time algorithm for solving the Markov decision process (MDP) with a constant discount factor. Furthermore, the computational complexity of the policy-iteration method (including the Simplex method) is superior to that of the only known strongly polynomial-time interior-point algorithm for solving this problem, which seems consistent with practical observation. The result is surprising since the Simplex method with the same pivoting rule was shown to be exponential for solving a general linear programming (LP) problem, the Simplex method with the smallest-index pivoting rule was shown to be exponential for solving an MDP regardless of discount rates, and the policy-iteration method was recently shown to be exponential for solving a undiscounted MDP. We also describe most recent progresses in this research direction.

The Tseng Memorial Lecture

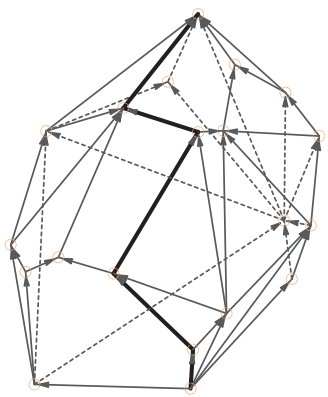
- Yinyu Ye: *Recent Progresses in Linear Programming and the Simplex Method*, 9.00–9.50, H 0105

Today's Weather

08:00	☼	19°C / 66.2°F
11.00	⛅	23°C / 73.4°F
14:00	⛅	26°C / 78.8°F
17:00	⛅	27°C / 80.6°F
20:00	⛅	25°C / 77.0°F

Happy Birthday, Simplex!

(al) In summer 1947, George Dantzig started to think about how to solve Linear Programs – and the result was a major impact on young linear optimization: his thoughts would eventually lead to the famous *Simplex-Algorithm*. Before that time, there were only four historic papers on (kind of) linear programming; most of them proposed something similar like the Simplex idea, "an idea that would occur to any trained mathematician", as Dantzig once noted. However, none of them were known to Dantzig at that time. He did himself what every trained mathematician would do: he searched contemporary literature and started to talk to others, among them the economist and later Nobel prize winner Tjalling Charles Koopmans, "to see what economists knew about the problem" and, later in Fall 1947 he contacted even "Johnny" von Neumann. However, at that time, the Simplex algorithm was already alive. It was born exactly in Summer 1947 – so it's 65th birthday must in fact be around ISMP 2012.



(©Michael Joswig and Thorsten Theobald)

But where does the name of the game come from? There is still some discussion about that question, although Dantzig answered it clearly: The columns of the constraints matrix together with the appropriate coefficients in the cost functional are spanning simplices. At first, however, the algorithm had a completely different working title. Since the objective was to be maximized in the first test cases, Dantzig and Leonid Hurwicz called it "climbing up the bean pole".

Optimal History on Tuesday

Gotthold Wilhelm Leibniz left about 200,000 sheets of paper on science, philosophy and literature, one of the largest legacies a scholar has ever produced. Since 1901, these works are edited in (up to now) 52 volumes, each of about 900 pages. So far, only one fourth of his mathematical works have been published.

The lecture will give a short survey of his biography and mainly deal with the following six aspects: 1. Leibniz as an organizer of scientific work: His presidency of the Berlin Academy of Sciences; 2. His rigorous foundation of infinitesimal geometry; 3. Leibniz as the inventor of the differential and integral calculus; 4. His conception of and his contributions to a general combinatorial art (symmetric functions, number theory, insurance calculus); 5. His proposals for engineering improvements in mining; 6. Leibniz's invention of the first real four-function calculating machine.

Eberhard Knobloch is professor of history of science and technology at TU Berlin and Academy professor at the Berlin-Brandenburg Academy of Sciences and Humanities (BBAW). He is a member of several national and international academies of sciences, president of the International Academy of the History of Science, past president of the European Society for the History of Science, Honorary professor of the Chinese Academy of Sciences. He published or edited more than 300 papers or books on the history of science and technology, he is a member of the editorial boards of sixteen international journals. His main scientific interests concern the history and philosophy of mathematical sciences and Renaissance technology. He is project leader of the A. v. Humboldt research group and the two Leibniz research groups at BBAW.

- Eberhard Knobloch: *Leibniz – Universal genius and outstanding mathematician*, 17.00–17.50, H 1012

The Puzzle

(al) In 1954, the twins Isaak and Akiva Yaglom published in Russian their nice book *Non-Elementary Problems in an Elementary Exposition*, which has been republished in English as *Challenging Mathematical Problems with Elementary Solutions 1 and 2*.

From the second volume come these two puzzles:

Is it possible to construct a network of ten bus lines such that after shutting down one line, one can still get from each bus stop to each other bus stop, but not when two lines are shut down?

Is it moreover possible to set up a system of two or more bus lines such that each line has exactly three bus stops, each pair of bus lines crosses each other at a bus stop and for each pair of stops, there is a bus line connecting it?

(By the way: Did you know that the DFG Research Center MATHEON optimized the 2005 timetable of the Berlin Underground in cooperation with BVG)?

Random Picks

- Polymake is software for computation in discrete geometry. Among others.
Michael Joswig: *polymake for integer linear programming*, 11.00–11.25, H 1058

- A bit more than one expects in real life problems: Semidefinite programing over infinite dimensions.
Cristian Dobre: *Infinite dimensional semidefinite programming*, 11.00–11.25, H 2038

- Growing semiconductor crystals? Don't try this at home, get instead in touch with someone who has lots of experience. Like Jürgen Sprekels.
Jürgen Sprekels: *Optimal control problems arising in the industrial growth of bulk semiconductor single crystals*, 13.15–13.40, MA 415

- Block coordinate descent methods can made faster by parallel computing.
Peter Richtarik: *Parallel block coordinate descent methods for huge-scale partially separable problems*, 13.15–13.40, H 1028

- Bad news for the extended formulations community.
Thomas Rothvoss: *Some 0/1 polytopes need exponential size extended formulations*, 15.45–16.10, H 3004

- The fast Fourier transform is well known. But did you ever hear of fast Fourier Optimization?
Robert Vanderbei: *Fast fourier optimization*, 16.15–16.40, H 1058

Optimal Spare Time: Mathematical Mitte I

(al) As we all learned already in the opening ceremony from the greeting words of Nicolas Zimmer (remember: the man with the high position in the Berlin Ministry for commerce, technology and research that cannot be translated in English), Berlin-Mitte is full of mathematical traces from history – mostly important the Humboldt University Berlin (HU) and the Berlin-Brandenburg Academy of Sciences, where many famous mathematicians and physicists have been active. To see some historical places, simply walk along *Unter den Linden*. The front part of house number 8 housed in the first half of the 20th century to the Academy of Sciences, at the time when Albert Einstein, Max Planck where working there. (In the backyard, there is one half of the Berlin State Library.) The building replaces since 1914 the original Academy building from 1700; these where the times when Gottfried von Leibniz or Leonard Euler were working there. Most members of the Academy taught as well at Berlin's oldest University, the Humboldt University with its main entrance next door at house number 6, for instance Karl Weierstrass, Constantin Carathéodory, Issai Schur, or Leopold Kronecker. The Fields Medal has its name from John Charles Fields – and he did there research together with Weierstrass, Klaus Julius Fuchs, Hermann Schwarz and Ferdinand Frobenius. If you have the time, step inside the foyer: there are glass windows from GDR times that show Newton, Leibniz and other scientists.

For more information and maps, please refer to the ISMP 2012 Berlin guide!

Quitting a walk in Berlin-Mitte (Photo: Christoph Eyrich)

One More Prize

(al) On Sunday, a pile of six prizes for excellent work in discrete and continuous optimization has been awarded. But there is at least one more prize in the peripherals of ISMP that has not been mentioned: The Richard Rado Prize, named after Richard Rado who studied mathematics in the 1930s in Berlin and earned his first doctorate there in 1933 with Issai Schur. Rado had to emigrate then from Germany and earned a second doctorate at Cambridge advised by G. H. Hardy. He is well-known from his intensive collaboration with Paul Erdős in combinatorics.

The prize had been awarded on Saturday at the "Symposium Diskrete Mathematik" which took place at the TU Berlin just before the ISMP. The winner is Heidi Gebauer from ETH Zürich for her thesis on combinatorial games; her advisor was Tibor Szabó from FU Berlin. She settled several of the "7 most humiliating open problems" from the book of József Beck on combinatorial games. (J. Beck, *Combinatorial Games: Tic-Tac-Toe Theory (Encyclopedia of Mathematics and its Applications)*, Cambridge University Press, 2008). The prize has been awarded by a divison of the German Mathematical Society (DMV) and it has been donated by Springer; it includes a prize money of 1,000 €.

And there are even more good news for the optimization community: At the same occasion, Juliane Dunkel from MIT got an "honorable mention" for her thesis on the Chvatal-Gormory closure in integer optimization (her advisor is Andreas Schulz). If you're interested, you can listen to Juliane talking about parts from her thesis on Thursday, 11.30–11.55 in room H 2033 (*A refined Gomory-Chvatal closure for polytopes in the unit cube*).

Optimal Reading

(Springer) There are several brand new books for the optimization community published by Springer – for instance *Multicriteria Portfolio Management* by Panos Xidonas et al. The authors present an innovative, integrated methodological approach to the construction and selection of equity portfolios. The text integrates stochastic methods for portfolio comparisons to offer a unified model for decision making in portfolio management.

Stefan Schäffler from the University of the German Federal Armed Forces in Munich published a book on stochastic optimization: *Global Optimization – A Stochastic Approach*. The volume presents its author's pioneering stochastic approach to global optimization across a range of disciplines, including mathematics and engineering. The new method confronts constrained and unconstrained problems and unifies our conceptual framework.

Lacra Pavel from University of Toronto sheds a new light on how to solve game theoretical problems in optical networks in her book *Game Theory for Control of Optical Networks*. She focuses on the design of control algorithms that optimally allocate the resources of these networks.

And from Erhan Çınlar and Robert J. Vanderbei comes a new first course in *Real and Convex Analysis* for scientists and engineers.

Springer is also proud to publish two journals in partnership with the Mathematical Optimization Society: Mathematical Programming (Editor-in-Chief Series A: Kurt M. Anstreicher, Editor-in-Chief Series B: Daniel Ralph) and Mathematical Programming Computation (Managing Editor: William J. Cook).

For more information and a full list of discounted ISMP titles, please visit booth 13 or check out www.springer.com/ismp

Warren Hirsch and his Conjecture

(al) There was some excitement about the disprove of the Hirsch conjecture in 2010 by Francisco Santos, professor for Mathematics from the University of Cantabria – and the Hirsch conjecture is also an important topic at this conference. Warren M. Hirsch is not only famous for his conjecture, but also (and mainly) for his works in mathematical biology, in particular in mathematical epidemiology: In the 1970s, he published together with his Ph.D. student, Ingemar Nasell, a mathematical model to describe the development of schistosomiasis (bilharziosis) in a quantitative approach by the means of Markov Chains, and he proposed then differential equation models for the description of the development of parasite worm populations in general.

Back to the conjecture: at the beginning of his career, Hirsch was also active in Optimization. In 1954, together with George Dantzig he brought up the fixed Charge Transportation Problem – a generic transportation problem together with fixed charges for the roads that have to be paid before the road is opened. In the year before, Hirsch had become professor for of mathematics at NYU's Courant Institute of Mathematical Sciences. And in 1957, 55 years ago now, he wrote a letter to Dantzig, where he conjectured that the graph of every d-dimensional polytope with n facets has diameter no more than $n - d$.

Meanwhile, we know that this is not true; Francisco Santos' construction of a 43-dimensional polytope with 86 facets and a diameter of at least 44 was only the beginning of a stream of counterexamples disproving Hirsch's conjecture. Now, people are working on the next steps: On September 30, 2010, Gil Kalai and others started officially the third polymath project, to prove or disprove the so called *polynomial Hirsch conjecture*. This conjecture can be stated in a completely combinatorial setting: Consider t nonempty families of nonempty subsets $\mathcal{F}_1, \ldots, \mathcal{F}_t$ of $\{1, \ldots, n\}$ with the following properties:

- The $\mathcal{F}_i$ are disjoint, that is: no set $\mathcal{S}$ belongs to two of the families $\mathcal{F}_i$, $\mathcal{F}_j$ for $i \neq j$.
- For every $i < j < k$, and every $\mathcal{S} \in \mathcal{F}_i$ and $\mathcal{T} \in \mathcal{F}_k$, there exists $\mathcal{R} \in \mathcal{F}_j$ such that $\mathcal{S} \cap \mathcal{T} \subset \mathcal{R}$.

Denote now by $f(n)$ the largest value of t such that these conditions can be satisfied. The question is then: is $f(n)$ a polynomial in n?

There are several talks today about the Hirsch Conjecture in session Tue.2.H 3008!

The Springer Booth (Photo: Andreas Loos)

The MOS Business Meeting

The business meeting of the Mathematical Optimization Society (MOS) will take place today at 18.15 in room H 0105.

All current and future members of MOS (so in fact practically all participants of the ISMP) are invited to take part. There will be reports on MOS activities – and you should in particular go there if you are keen on learning where the ISMP 2015 will take place: this will also be announced at the meeting.

The Airport-Service

(js) This ISMP, about 500 participants arrived by plane at the Berlin airports TXL and SXF and used our airport registration service. 40 people welcomed the participants, registered them, and helped them to taxi and public transport. With that service, participants got around the queues at the registration desk and had their tickets for public transport available from the first minute on. We thank all helping hands that made this service a big success!

Berlin SXF (Photo: Günter Wicker/Berlin Brandenburg Airport)

Standing in the West or in the East?

(al) Did you ever wonder how to find out whether you are standing in the former East Berlin or in the West? The Berlin Wall that separated the Eastern Part of Berlin from the West between 1961 and 1989 was not at all a straight line going from North to South: instead, it rather went from the North-West to the South-East, with a bulge in the middle (which is today the district Mitte). At some places, you can find two rows of cobblestones crossing streets or places: these mark where the Berlin Wall formerly was.

But there are other ways to find out where you are. The easy way is to watch for traffic lights for pedestrians: in the western part, you see on most traffic lights the pictogram of a simple man, while in the eastern part, the man usually has a hat on (and a big fan base therefore). However, since 2005, this rule is not strict anymore: There are now some few traffic light men in the west, too, and also vice versa simple traffic lights in the east.

However, there are more east-west-indicators, and they come from the kitchen: in the 1980s, there came ten thousands of immigrants from communist North Vietnam to East Berlin to work there as contract workers. They had to find new jobs after the Berlin Wall came down, so most of them set up their own business with grocery and vegetable shops or food stalls – so you find Vietnamese food mainly in the East. On the other hand, West Berlin (and especially Kreuzberg) was a favored destination for immigrants from Turkey. That's why Döner or Falafel can be found there. And then there is a strange invention from GDR: the roast chicken are called *Broiler* in the East (and only there). And no one knows exactly who started that tradition!

"Ampelmännchen" at Brandenburger Tor (Photo: Christoph Eyrich)

Questions? Comments? Remarks? Just send us an E-Mail: andreas.loos@fu-berlin.de. More News? Visit us on the web: ismp2012.mathopt.org/en/news

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