Optima@ISMP

Editorial

The ISMP 2012 is almost over now – and even from the news editor's position who was feeding you with all the announcements, information and gossip around the conference in the last five days via daily newsletters and news blog, it was a great success. We had it all: ups (a great show at the beginning and a whole bunch of prizes), danger and suspense (remember the problems at Newark airport), bad news (a handful of talks had to be cancelled), and broken world records (more participants and more talks than ever at an ISMP). Unfortunately, there was no baby born during the ISMP 2012, we had no participant from Antarctica – at least as far as I know – and that annoying $\mathcal{P}$ vs. $\mathcal{NP}$ question is also still open. (Why? Did you do too much sightseeing?)

Nevertheless, I hope that all of you come well home – with many new ideas for future research and many great reminiscences of a vibrant town with lots of maths inside. And I hope you will return to Berlin soon! Andreas Loos

The lower part of 124.5° by Bernard Venet (Photo: Christoph Eyrich)

Today's Plenaries

- Nikhil Bansal: *Semidefinite Optimization in Discrepancy Theory*, 09.00–09.50, H 0105
- Xiaojun Chen: Nonsmooth, *Nonconvex Regularized Optimization for Sparse Approximations*, 09.00–09.50, H 0104
- Jorge Nocedal: *Second-Order Methods for Stochastic, Semi-Smooth and Nonlinear Programming*, 17.00–17.50, H 0105

Random Picks

- How is information distributed in social networks? The story of an experiment.
Markus Möbius: *Treasure hunt*, 11.30–11.55, MA 043

- What if the travelling salesman may miss Paris but has to visit at least the *banlieue* of Paris?
François Margot: *The traveling salesman problem with neighborhoods: MINLP solution*, 11.00–11.25, MA 041

- PageRank generalized: How do you maximize clicks per time on certain links in a website?
Olivier Fercoq: *Polyhedral and ergodic control approaches to PageRank optimization and spam detection*, 13.15–13.40, H 3503

- Nuclear power plants reloaded.
Roman Cada: *Optimizing nuclear fuel reload patterns*, 14.15–14.40, MA 550

- Slime molds are brighter than one might think!
Vincenzo Bonifaci: *Physarum can compute shortest path*, 15.15–15.40, H 3010

- Maximum flow problem on n nodes and m arcs can be computed in $\mathcal{O}(nm)$!
Unfortunately, James Orlin's exciting talk on *Max flows in $O(nm)$ time and sometimes less* had to be canceled. But it is available on the internet under this address: techtv.mit.edu/videos/20427-max_flows_in_o-nm-_time

Lagrange in Berlin

(al) Last Sunday, the Lagrange prize has been awarded to Emmanuel Candes and Ben Recht. Only few know that Joseph-Luis Lagrange spent about twenty years of fruitful work in Berlin. And even fewer know that Lagrange was not a Frenchman (as the name might suggest), but an Italian. Born in Turin 1736, he co-founded the later *Royal Academy of Sciences* and worked as a mathematician there. (Langrange allegedly once commented that with something like "I was young and I needed the money.") But in fact, he was more than only young: He was a good mathematician and he was modest. The "Lion" Leonard Euler seemingly scared him a bit – although Euler tried to entice him to the Berlin *Academy of Sciences*. Lagrange was elected to the Academy in 1756. But it took ten more years to make him Director of Mathematics at the Berlin Academy – after Euler had left to St. Petersburg. Lagrange worked in Berlin on astronomy, dynamics, probability and the foundations of calculus – much of the stuff we know him for has been produced in Berlin. His working conditions here were fantastic, but his health (and that of his wife) was not: she died in 1783, and he was also often ill. Then even his boss Frederick the Great died in 1786. So, Lagrange finally left Berlin in 1787 to go to the Académie des Sciences in Paris – to open a new chapter in his life.

Today's Weather

08:00	☼	15°C / 59.0°F
11.00	🌤	18°C / 64.4°F
14:00	🌤	21°C / 69.8°F
17:00	🌤	23°C / 73.4°F
20:00	☼	21°C / 69.8°F

"I do exciting things"

(al) Robert Bixby is probably one of the best known people in the optimization community. He is one of the founders and the 'bi' of Gurobi, the "overall fastest and best supported" Mathematical Programming Solver, as they advertise it, to distinguish Gurobi from CPLEX. CPLEX however was also a Bob Bixby project from the very first beginning in 1988 until 2008, when Bixby founded Gurobi together with Zonghao Gu and Edward Rothberg. Within a few months, they've made it a state of the art solver. We talked with Bob Bixby about math business and his future.

optima@ismp: What was the most exciting talk you heard up to now at the ISMP?

Bixby: That might be surprising, but it was the historical talk of Horst Zuse. I found that talk really fascinating. He did very interesting things, and he is a really interesting person.

optima@ismp: Assume that CPLEX and/or Gurobi are already on the market and you are young again. What kind of math business would you start now? Or, phrased differently: Assume someone comes to you and tells you, she wants to found a math company – what would you tell her?

Bixby: I am probably not the right person for a question like that. I am doing what I do because I am excited about it, I am not interested in inventing new businesses. And if someone asks me "do you have an advice for me founding a company" – well, I would probably tell her that one thing you have to do is be prepared to take risks. That's something people often do not. Another thing you have to do: you have to recognize what you are good at and what not. That's not that easy. And then another hard question is this: what is the market for this thing that I created. People often think: "I have this code, I can solve something with it, this is cool." But you need to look at it from the point of view of possible customers.

optima@ismp: And what field of mathematics looks most promising to you?

Bixby: Stochastic programming is really something. To this very day, nobody has figured out how to provide a product that satisfies the need to formulate and solve stochastic programs.

optima@ismp: When you left CPLEX and started Gurobi, you did not choose such a new field; instead you stayed with MIP. Why did you leave CPLEX then?

Bixby: CPLEX was not a strategic product for ILOG. There was never a vision for what could be done to expand the use of Linear Programming based optimization tools.

optima@ismp: Did you ever think of making CLPEX or Gurobi an open source project to make benchmarking in research more transparent?

Bixby: That would never have occurred to me. It's hard for me to imagine how to really build a business around an open source optimization tool.

It's also part of the measure of the success to see: do people still want to pay for it? It's part of the excitement. You do these things mostly because of having fun. And I think it wouldn't be as much fun in open source.

optima@ismp: And perhaps it's also not a guarantee to be better when people collaborate…

Bixby: Oh, no, it absolutely is not. It's probably a guarantee to be *not* good in Mixed Integer Programming.

optima@ismp: What about SCIP, which is an open source IP solver?

Bixby: That is probably the best IP solver after CPLEX, XPRESS and Gurobi, but I don't think it got significantly better over the last years.

optima@ismp: Do you sometimes miss being at a university?

Bixby: Well, I come to Germany regularly now to teach classes in Erlangen. I like giving lectures, and I like explaining things, but honestly, I don't miss university life. You wanna do something interesting that teases your brain – and I do exciting things. Teaching includes a lot of other things. Like exams.

Go Underground!

(al) Had enough summer for the moment? Go underground– into one of the bunkers of Berlin. The *Verein Berliner Unterwelten* (Berlin Underworlds Association) is giving guided tours trough several of hundreds of tunnels, bunkers and basements under the Berlin ground. One of the most amazing buildings is the Tower in *Humboldthain* (S Gesundbrunnen) with a "museum" (in fact a bunker by itself) nearby. Both can be visited in guided tours at fixed times (single visitors just drop by at the museum, groups better book in advance).

More information:
http://berliner-unterwelten.de

The Puzzle

(al) Here is a puzzle of one of the kings of games John H. Conway who celebrates his 75th birthday this year on December 26. In the 1960s he defined a *thrackle* as a drawing of a graph such that each two edges are either incident in one vertex or crossing each other exactly once. The big and open question is: Are there thrackles with more edges than vertices? Our smaller question here is: Can you show that bipartite trackles are always planar (which is a result of Lovász, Pach and Szegedy from 1997)?

At the news stand (Photo: Christoph Eyrich)

MOS members get it for free: *OPTIMA*, the *Mathematical Optimization Society Newsletter*. Three issues per year. A commented optimization target article, discussion, and news. Delivered to your postbox.

Pick up a previous issue at the information desk in the Main Building.

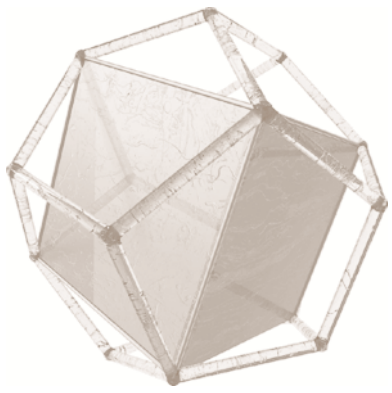
You Can Help Us!

(al) Since yesterday, there is a small form online available to help the organizers to make ISMP better. They would like to know how you found the conference and if you have any remarks. Please help them by filling out the form; the link can be found on the ISMP website and in our news blog. Of course, your opinion is treated anonymously. Thank you!

Optimal Spare Time: Mathematical Mitte II

(al) Some mathematical exhibits can be found next to train station *Zoo*. There is a shopping mall nearby, called *Europa-Center*, where two nice clocks can be found: One is the *Berlin Clock* at the entrance *Budapester Straße* that has been set up in 1975 and shows the time in 24h format as numbers to the base 5 in graphical form. The other one is inside *Europa-Center*: A clock working of 13 m height that shows the time by filling glass balls with colored water.

If you have the time, then you can walk along *Tauentzienstraße* (along the southern side of the Europa-Center) into eastern direction to reach the Urania: There is the large



A cube inside a dodecahedron glass cage, to show the basic idea for the sculpture in *Kaufhaus des Westens* (Image: Andreas Loos)

124.5° arc from the french mathematical artist Bernard Venet, a gift to celebrate the 750 year jubilee of Berlin in 1987. On the way there, you will pass the famous *Kaufhaus des Westens* ("Shopping-mall of the West"), where you can not only buy souvenirs but also step in for mathematical reasons: last week, a team of students from the Freie Universität Berlin has built there a large plastic model of the intersection of one of the five cubes that lie inside a dodecahedron with the remaining four cubes. A stunning view!

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

"Raindrops keep fallin' on my head . . ."

Hot days, warm nights – there were already thunderstorms over the ISMP 2012, and there will come more. Suppose now it's raining and you have to cross the large "Straße des 17. Juni" between the Mathematical Institute and the TU main building, suppose moreover that you forgot your umbrella and the traffic lights are by wonder permanently green for the pedestrians – how fast should you cross the street?

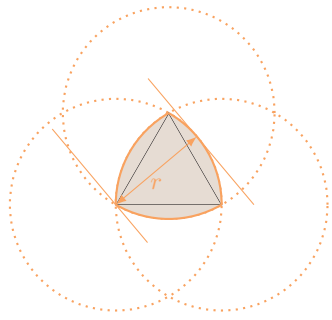
Clearly, if you stand still for an infinite time, infinitely many raindrops keep fallin' on your head, you get infinitely wet – and you miss all the talks. If you move very slowly, the number of drops on the head decreases while the number of drops on the front of your body increases. And a very, very fast running person gets on the other hand a fixed amount of rain on the front of it's body, depending on how dense the rain is. The person itself is usually modeled as a cylinder. But what is its optimal speed? And is this model correct anyway? (It's not perfect, but it works, I think.)

About four weeks ago, physicist Franco Bocci from the University of Brescia published a "novel approach" (as he wrote) to solve this problem (F. Bocci, *Whether or not to run in the rain*, Eur. J. Phys. 33 (2012), pp. 1321–1332) – and produced a huge media response with that (just try a short google search). "Novel" means in this case mainly that the author allows for the moving bodies to have different forms – they may look like rectangular planes or parallelepipeds, cuboids or cylinders. But his main results are also not really new, since they are essentially the same as those found by David E. Bell in the 1970s. He wrote on the question *60.21 Walk or Run in the Rain?* in The Mathematical Gazette (Vol. 60, No. 413. (Oct., 1976), pp. 206–208). Bells short answer after a short analysis of the problem is this: "Keep pace with the wind if it is from behind; otherwise, run for it."

Our tip: include in your schedule our first approximation to the weather in the wheaterbox below!

A Hello from Reuleaux

(al) He was one of the founders of mechanical engineering in a time when machines were still machines: Think of piston rods, cog wheels and lots of steam. But Franz Reuleaux, born in 1829 in Eschweiler, was not only a machinery man. He was also the first Rector of the *Königliche technische Hochschule* in Charlottenburg – which is the predecessor of TU Berlin, where ISMP 2012 is taking place. And although being an engineer by heart, he gave a nice object to mathematics, published in 1875 in his famous book *Theoretische Kinematik*: The *Reuleaux Triangle*.



Two Meissner Bodies and a Reuleaux-Tetrahedron (bottom left). Note that the Meissner Bodies have three rounded edges each, by inserting golden "spindles". (Image: Andreas Loos)

MATHEON and the Berlin Mathematical School

(al) Berlin is a nice place – especially for mathematicians. Apart from the three Universities and other research institutes, there is the MATHEON, a joint initiative of the three Berlin universities (FU, HU and TU) and the mathematical research centers WIAS and ZIB. It will be funded by the German Research Foundation DFG (Deutsche Forschungsgemeinschaft) until 2014.

Another interesting offer to future mathematicians is the Berlin Mathematical School (BMS), a joint graduate school of the mathematics departments of the three major Berlin universities, TU, FU, and HU. They offer coordinated course programs in English from bachelor to qualifying exams in two years and give then access to all math research groups in Berlin for a PhD. Included is an intensive mentoring during the whole duration of studies, an extensive support in any aspect. The program is completely in English, so German language skills are not necessary.

Is that perhaps a reason to come back to Berlin?

Further information:
http://www.matheon.de
http://www.math-berlin.de

To build a Reuleaux Triangle, one takes an equilateral triangle with side length r and draws a circle of radius r around each vertex of the triangle. The intersection of the three circles gives you something that has the same thickness in each direction; it is an example of a curve of constant width (just as the circle). And it is interesting for optimization professionals: the Reuleaux-Triangle has the smallest area among all two dimensional curves sharing the same constant width.

Want some generalization? Take a tetrahedron, draw balls of radius r around the vertices – and you obtain a body that is *not* of constant width, unless you grind off three edges incident either to the same vertex or to the same face. (In each case, you have a *Meissner Body* in hands.) It is an open question whether the Meissner Bodies have smallest volume among all bodies with constant width in three dimensions. Recently, HaiLin Jin and Qi Guo found at least that Meissner Bodies are extremal in terms of their asymmetry (Discr. & Comp. Geom. 47 (2) (2012), pp. 415–423). But for the minimal volume, the search goes on – also in higher dimensions: Lachand-Robert and Oudet gave a method to construct bodies of constant width in arbitrary dimension (Math. Nachrichten, 280 (7) 2007, pp. 740–750).

9 p.m. at Oktoberdruck: Printing of *optima@ISMP* is about to begin (Photo: Christoph Eyrich)

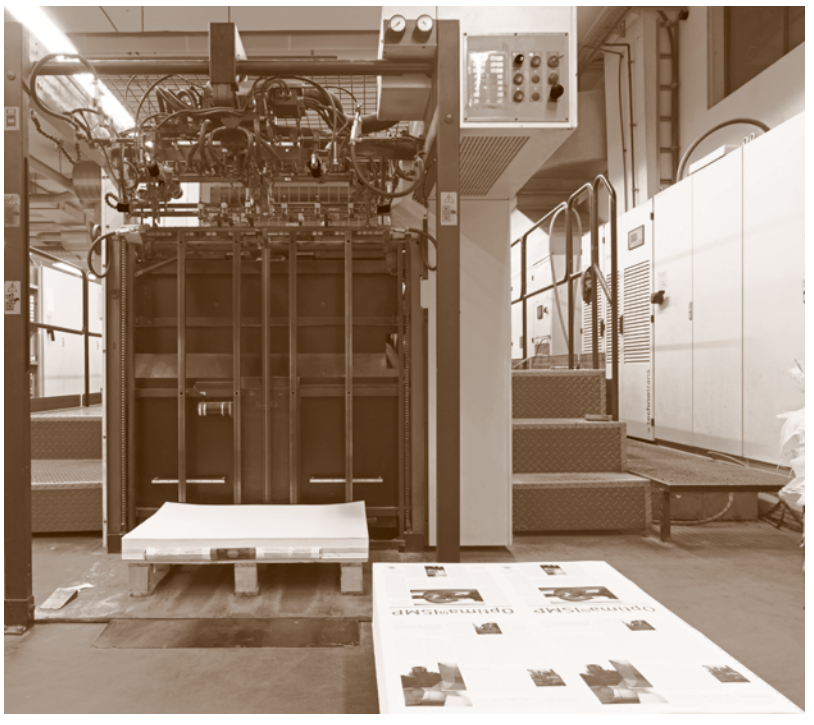
Let's Have a Look at the Statistics

(al) We had 2038 participants and about 1700 talks – this ISMP broke all records. But where did you optimizers come from?

An (almost optimal) TSP-tour around the world (Image: Bill Cook and David Applegate)

Time to do a bit statistics. Most of the participants came from Germany (a bit less than 25 %); from the USA came about 20 %, and from France came about 6 %. Then came (in order) participants from Great Britain, Brazil, Canada, the Netherlands, and Japan; which made about 4–3 % each.

In total, there were participants from 61 countries around the world, even from countries like Tunisia, Malawi, Nigeria, Mongolia or Iceland! Probably the longest journey had two participants from New Caledonia and eight participants from New Zealand – the antipodal point of Berlin lies a bit to the East (that is: about 4000 km) of New Zealand in the South Pacific Ocean.



Where this copy of *optima@ISMP* has been produced a few hours ago: The feeder system of one of the printing machines at Oktoberdruck, Berlin (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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