Chapter Highlights

Charles University in Prague Chapter of SIAM

June 26, 2014

Workshop of SIAM SC Prague

In March our Chapter organised three days long international workshop. We invited representatives of Chapters from Magdeburg, Heidelberg, Manchester, as well as members of our Chapter and academic staff of the Faculty of Mathematics and Physics at Charles University.

The first day in the afternoon on March 20, we started with an invited talk on Crouzeix's Conjecture given by Anne Greenbaum who is a professor of applied mathematics at University of Washington in Seattle. After the talk we kept discussing about Crouzeix's Conjecture and other conjectures over the unofficial workshop dinner in a near restaurant. Having dinner together was highly appreciated.

The next morning, March 21, the technical programme of the workshop started. The Chapter advisors appreciated the high quality of talks and presentation skills of speakers. The lunch and coffee breaks were filled with lively discussions on wide range of topics covered by the speakers. When the scheduled programme was over we went together to see Prague Castle and Malá Strana.

The last day, March 22, was devoted to sightseeing. We went to Clementinum, the complex of buildings from 16th century (the former Jesuit part of the University), near river Vltava where the National Library of the Czech Republic is currently located. There we visited the Baroque Library hall and also the oldest weather observatory with continuous record since 1775. Later we went to the Old Town which is the heart of the city of Prague.

We acknowledge the financial support of Faculty of Mathematics and Physics that covered the Friday lunch, the entrance to Clementinum and the accommodation of speakers.

You can see the list of speakers and their talks is given below. We also enclose the book of abstracts.

- **Anne Greenbaum** (University of Washington) – Crouzeix's Conjecture
- **Marie Kubínová** (Charles University in Prague) – Noise Revealing in Golub-Kahan Bidiagonalization and Regularization in Discrete Inverse Problems
- **Mattia Tani** (University of Bologna) – CG Methods in Non-standard Inner Product for Saddle-point Algebraic Linear Systems with Indefinite Preconditioning
- **Bjoern Baran** (Otto von Guericke University Magdeburg) – On the Numerical Solution of Large-scale Linear Matrix Equations Using Python
- **Pawan Goyal** (Otto von Guericke University Magdeburg) – MOR of Quadratic-Bilinear Differential Algebraic Equations
- **Samuel Relton** (University of Manchester) – Fréchet Derivatives of Matrix Functions and their Applications
- **Robert Kircheis** (Heidelberg University) – Microbial Enhanced Oil Recovery and Efficient Parameter Estimation
- **Pavel Hron** (Heidelberg University) – Reactive Transport Modelling in Unsaturated Porous Media
- **Helena Švihlová** (Charles University in Prague) – Imaging, Modelling and Computations of Hemodynamics in Cerebral Aneurysms

- **Martin Řehoř** (Charles University in Prague) – Mathematical Modelling of Float Glass Forming Process
- **Barbora Benešová** (RWTH Aachen University) – An Implicit Midpoint Spectral Approximation of Nonlinear Cahn-Hilliard Equations
- **David Obdržálek** (Charles University in Prague) – From Zero to Robots in Half an Hour

SIAM SC Seminar

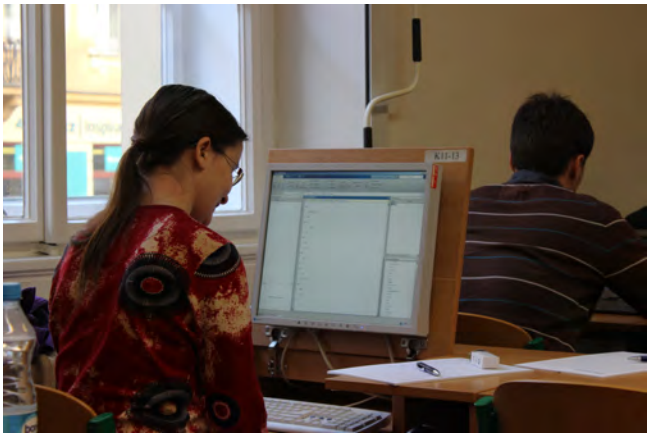
In the academic year 2013/2014 we held a regular seminar at the Faculty of Mathematics and Physics which attracted students and researchers from various fields of mathematics. As you can see in the list of talks below, we managed to put together interesting topics ranging from the analysis of rounding errors to the mathematical modelling problems.

As in the previous academic year we were keen on improving presentation skills of speakers. To this end we kept the tradition of evaluation forms where anybody in the audience could express anonymously their opinions and feelings about the speaker and the presentation they had seen. After each talk there was a very lively discussion about speaker's work as well as about how to improve in speaking in front of an audience.

After the discussion with representatives of several other Student Chapter at the SIAM Annual Meeting 2013 in San Diego, we decided to conclude each seminar by having pizza in order to attract students to attend the seminars.

- **Marie Kubínová** (Dep. of Numerical Mathematics) – A Brief Introduction to Compressed Sensing and Low-Rank Matrix Completion Problems
- **Jan Hodic** (Charles University Institute of Mathematics) – Quantum Turbulences from the Mathematical Modelling View
- **Jan Kalina** (Institute of Computer Science, AS CR) – Classification Methods for High-Dimensional Genetic Data
- **Martin Franců** (Dep. of Mathematical Analysis) – A Brief Introduction to Lorentz Spaces
- **Karel Chvalovský** (Institute of Computer Science, AS CR) – A Few Words about Automated Theorem Proving
- **Vít Orava** (Charles University Institute of Mathematics) – From a Model — through Analysis — to Numerics
- **Petr Tichý** (Institute of Computer Science, AS CR) – Computations and Rounding Errors
- **Petr Petráček** (Dep. of Mathematical Analysis) – Lineability of Nowhere Monotone Measures
- **Mónika Balász** (Dep. of Numerical Mathematics) – ALE Method, Discontinuous Galerkin Method and their Combination
- **Marek Netušil** (Charles University Institute of Mathematics) – A Mathematical Model of an Arterial Wall

Introduction to Programming in MATLAB



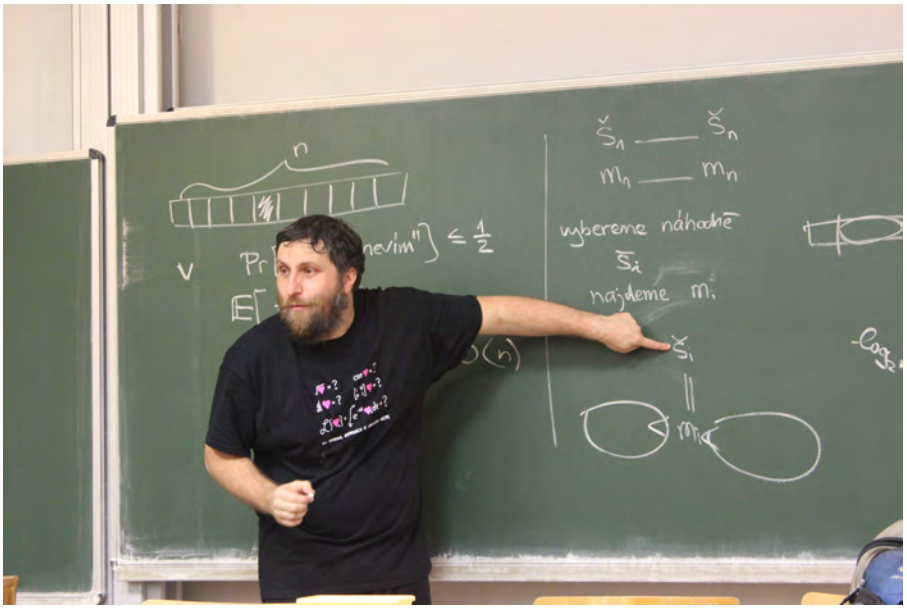
As in the academic year 2011/2012 the students and Chapter members Marie Kubínová and Jan Papež organised, with a support of our Chapter and of the Faculty of Mathematics and Physics, a five-day intensive programming course "Introduction to Programming in Matlab". The form of this workshop partially originates form the courses offered at ETH Zürich where Marie stayed in year 2010/2011. The aim of the course was set to give a brief introduction to the programming in MATLAB with emphasis on how to solve real-life problems in a clever way. After five days the participants should be able to write and run the experiments required for their projects and higher degree theses. Here the organizers make use of their own experience – they believe that the workshop helps to avoid the inefficient "trial and error" approach.

Similarly to the year 2011/2012, the workshop attracted students of various fields. It was attended by 18 participants from several faculties of our University: Faculty of Mathematics and Physics, Faculty of Science and First Faculty of Medicine. We are very happy that this event helped to extend the awareness of Chapter and its activities over the University.

Invited talk – Martin Mareš

One of the Chapter activities is to invite alumni of the Faculty of Mathematics and Physics. This year we decided to ask Martin Mareš to give a talk aimed at undergraduate students. Martin Mareš is an assistant professor at the Department of Applied Mathematics and he won a dean prize for the best teacher at the Faculty of Mathematics and Physics in the academic year 2012/2013. He accepted our invitation and prepared a talk about randomness and randomized algorithms.

In his talk he covered topics from the computational complexity, graph algorithms, randomness and cryptography. He was able to illustrate everything on interesting examples everybody could understand. As a consequence people in the audience were responsive till the very end. We believe that many undergraduates became much more enthusiastic about mathematics after this talk.



Posters

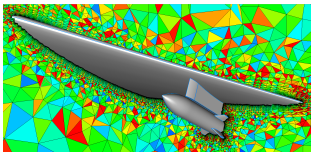
SIAM Student Chapter

Charles University in Prague

Knowledge is nothing if not shared

SIAM Student Chapter zve všechny studenty bakalářského studia na

Setkání se studenty matematického modelování a numerické matematiky



Rozhodujete se, kam na navazující magisterské studium?

Vybrali jste si matematické modelování nebo numerickou matematiku a chcete se o nich dozvědět více?

Využijte možnosti setkat se se studenty těchto oborů a zjistit, co studium obnáší a co vám může nabídnout.

Přijďte ve středu **9. října**
od **14:00** do **Respiria**

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SIAM Student Chapter

Charles University in Prague

Studentská komora akademického senátu MFF UK a SIAM Student Chapter zvou na

Setkání s úspěšnými žadateli GAUKu

Chystáte se podat žádost o grant GAUK? Nevíte, co má obsahovat? Sháníte tipy, jak žádost napsat?

15. října v **17:20**, posluchárna K1

Informační schůzka, kde se dozvíte

co to je GAUK, kde najít informace,
co si rozmyslet před psaním žádosti,
jak vypadají úspěšné žádosti,
jakých chyb se vyvarovat.

29. října v **17:20**, posluchárna K1

Setkání nad předběžnými verzemi vašich žádostí. Některý z úspěšných žadatelů si spolu s vámi projde váš návrh grantu a poradí vám, co je třeba vylepšit.

tyto termíny jsou určeny především žadatelům z matematické a fyzikální sekce, pro informatiky jsou připravena setkání v jiných dnech

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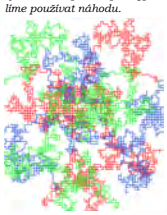
SIAM Student Chapter zve na přednášku

Martin Mareš, Katedra aplikované matematiky

Náhoda v informatice

17. prosince od **17:20** v **K1**

Počítače obvykle vnímáme jako deterministické stroje řídící se předem známým programem. Je tomu opravdu tak? Ukážeme, že spousta obtížných úloh, které potkáváme v praxi, se výrazně zjednoduší, pokud při výpočtech dovolíme používat náhodu.



Martin Mareš pracuje na Katedře aplikované matematiky jako odborný asistent. Vyučuje, mimo jiné, Grafové algoritmy a Úvod do řešení problémů kombinatorických, matematických i jiných. Na své domácí stránce o sobě píše:

```
-----BEGIN GEEK CODE BLOCK-----
Version: 3.1
GCS/M d- s:++ a C++ UL++++$ P++ L+
+++ E- W++ N+ o+ K w--- O- M !V
PS+ PE+ Y+ PGP++ t 5? X R !tv b+
+(+++) DI D--- G+ e++++ h- r+++ y?
------END GEEK CODE BLOCK------
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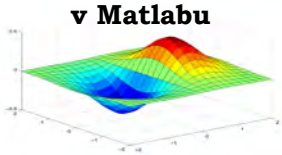
Úvod do programování v Matlabu



kurz pro začátečníky především studenty 3. ročníku numeriky a modelování ale i další zájemce

10. - 14. února 2014 vždy **9:00 - 12:00**
v učebně K11 v Karlíně

seznámíte se s Matlabem,
naučíte se používat vestavěné funkce i psát své vlastní,
zjistíte, jak vykreslovat a ukládat výsledky,
povedeme vás k přehlednému a efektivnímu kódu
a především si vše sami hned vyzkoušíte

více informací: www.papez.org/matlab
kontakt: jan@papez.org
přihlášení: e-mailem do 3. února

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SIAM SC zve na přednášku

Anne Greenbaum
University of Washington

Crouzeix's Conjecture

20. března od **17:20** v **K1**

úvodní přednáška v rámci **Prague SIAM Student Chapter Workshop**

In 2004, Michel Crouzeix made the fascinating conjecture that for any n by n matrix A and any polynomial p

$$\|p(A)\| \le 2\|p\|_{W(A)} \qquad (1)$$

Here $\|\cdot\|$ on the left-hand side denotes the operator 2-norm and $\|\cdot\|_{W(A)}$ on the right denotes the ∞-norm on the *field of values* or *numerical range*,

$$W(A) = \{q^*Aq : q \in \mathbb{C}^n,\ q^*q = 1\}.$$

Crouzeix was able to prove the result with the constant 2 replaced by 11.08, but the method of proof could not be extended to give the conjectured value of 2 (which cannot be improved upon since there are matrices and polynomials for which $\|p(A)\| = 2\|p\|_{W(A)}$).

In this talk, I will discuss some background and related results, as well as applications. I will identify some classes of matrices / polynomials for which (1) is known to hold — e.g., 2 by 2 matrices and matrices whose field of values is a disk, linear polynomials and simple powers $p(z) = z^k$, $k = 1, 2, \ldots$ — and also some, seemingly trivial classes, for which it still is not known whether inequality (1) holds — e.g., general 3 by 3 matrices [Crouzeix recently proved the result for 3 by 3 nilpotent matrices], or general quadratic polynomials. I will discuss numerical studies and possible approaches to a proof.

This talk covers joint work with: Daeshik Choi, Vance Faber, Adrian Lewis, Michael Overton, and Nick Trefethen.

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SIAM Student Chapter in Prague organizes

Prague SIAM Student Chapter Workshop

Technical programme, March 21

start at **9:30**, lecture hall **S4**
(Malostranské náměstí 25)

9:30 *Opening*
9:45 **Marie Kubinová** - Noise Revealing in Golub-Kahan Bidiagonalization as a Mean of Regularization in Discrete Inverse Problems
10:10 **Mattia Tani** (Univ. of Bologna) - CG Methods in Non-standard Inner Product for Saddle-point Algebraic Linear Systems with Indefinite Preconditioning
10:35 *Coffee break*
11:00 **Björn Baran** (Otto von Guericke Univ. Magdeburg) - On the Numerical Solution of Large-scale Linear Matrix Equations Using Python
11:25 **Pawan Goyal** (Otto von Guericke Univ. Magdeburg) - MOR of Quadratic-Bilinear Differential Algebraic Equations
11:50 **Samuel Relton** (Univ. of Manchester) - Fréchet Derivatives of Matrix Functions and their Applications
12:15 *Lunch*
14:00 **Robert Kircheis** (Heidelberg Univ.) - Microbial Enhanced Oil Recovery and Efficient Parameter Estimation
14:25 **Pavel Hron** (Heidelberg Univ.) - Reactive Transport Modeling in Unsaturated Porous Media
14:50 *Coffee break*
15:15 **Helena Švihlová** - Imaging, Modeling and Computations of Hemodynamics in Cerebral Aneurysms
15:40 **Martin Řehoř** - Mathematical Modeling of Float Glass Forming Process
16:05 **Barbora Benešová** (RWTH Aachen Univ.) - An Implicit Midpoint Spectral Approximation of Nonlinear Cahn-Hilliard Equations
16:30 *Closing remarks*

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Mathematics & Statistics at MSD

Matthew Wiener, leader of Analytics & Data Sciences group at MSD IT Global Innovation Center in Prague, will give a talk and offer **positions** and summer **internships**

April 29 (Tuesday) **15:40**, lecture hall **K1**

The pharmaceutical industry faces rapidly changing circumstances. Patients, prescribers and payers demand significant improvements over the standard of care – producing a therapy with a different mechanism of action from drugs on the market is not sufficient. Put another way, the public and health authorities want a better risk/benefit profile, and they want it at lower cost. Finally, the amount and complexity of data (both data generated by pharmaceutical companies in clinical trials and "real-world" data from doctors and insurers) continues to increase, raising hopes (and expectations) for "personalized medicine", where treatment will be tailored to each patient. This talk will present examples of how MSD uses data analysis, statistics, and mathematical modeling to improve how we discover, manufacture, and distribute therapies to prevent and cure disease.

Matthew Wiener

MSD *Be well*

MSD is an innovative, global healthcare leader committed to improving health and well-being in 140 countries around the world. Our product categories include heart and respiratory health, diabetes, infectious diseases, consumer products and women's health. We continue to focus our research on conditions that affect millions of people around the world – diseases like Alzheimer's, Diabetes and Cancer - while further expanding our strengths in areas such as vaccines and biologics. We aspire to be the best healthcare company in the world and are dedicated to providing innovative solutions for tomorrow.

MSD is known as Merck in the United States and Canada.

further information with position offers at **siam.cuni.cz**