Olaf Schenk CV

1. Personal Information

Università della Svizzera italiana (USI)	Email:	olaf.schenk@usi.ch
Faculty of Informatics	Phone:	+41 58 666 4850
Lugano, 6900, Switzerland 13	Research Webpage:	http://usi.to/ovv
Nationality: German	ORCID:	0000-0001-8636-1023

2. Education & Scientific degrees

University of Basel, Switzerland	Computer Science	Habilitation, 01/2010
ETH Zurich, Switzerland	Information Techn.&Electrical Eng.	PhD, 06/2001
Karlsruhe Institute of Technology, Germany	Applied Mathematics	Diploma, 12/1995

3. Current Positions

Full Professor	Università della Svizzera italiana (USI)
External Lecturer	ETH Zurich (as of 02/2020)
Director	Informatics PhD Program, USI; Computational Science M.S. Program, USI
Vice Chair	SIAM, Activity Group on Supercomputing
Advisory Position (20%)	Swiss National Supercomputing Centre (CSCS)

4. Previous Position(s)

USI	Associate/Full Professor	01/2012–present
University of Basel	Senior Research Associate	01/2005–12/2011
IBM T.Watson Research Center, Yorktown, USA	Postdoctoral Fellow	01/2005–12/2005
University of Basel	Postdoctoral Fellow	04/2001–12/2004

5. Research Interests

Scientific computing, high-performance computing, computational science and data analytics, extreme-scale computing in computational algorithms, application software, programming, and software tools.

6. Fellowships and Awards

- Research awards: IBM Faculty Award (2007); Innovative and Novel Computational Impact of Theory and Experiment, DOE Leadership Computing Award (INCITE), with J. Tromp (Princeton) (2013, 2014).
- Honor: SIAM SIGEST Honor with Prof. M. Bollhöfer (TU Braunschweig) (2008).
- Program Director (2016-2017) and Vice-Chair (2018-2019) of the SIAM SIAG on Supercomputing (SIAM special interest group on supercomputing). Nominated by a committee, elected by all SIAG members.

7. Supervision of Junior Researchers and Postdoctoctoral Fellows

Since 2012 I have advised 4 Postdocs, 9 PhD students, 13 MSc students, 5 BSc students, and served on the committee of 17 PhD students (external member). Here is a sublist of advised PhD students: D. Pasadakis (2018-), A. Eftekhari (2017-), R. Janalik (2015-), J. Kardos (2015-), F. Verbosio (PhD 2018), M. Rietmann (PhD 2015), J. Huber (PhD 2013), M. Sathe (PhD 2012), M. Christen (PhD 2012). Most of my PhD and postdoctoral students are now working in Swiss industry in companies such as Disney Research, NVIDIA, and Google.

8. Teaching activities (since 2012 unless stated differently)

Undergraduate: HPC Lab (ETH Zurich, Spring 2020), Numerical Computing (USI); Graduate: HPC, Software Atelier: Simulation, Data Science & Supercomputing, SIAM Gene Golub Summer School on High Performance Data Analytics (2019), Effective HPC & Data Analytics Summer School.

9. Organization of conferences (pp = #participants)

- General Chair: SIAM Conference on Parallel Processing for Scientific Computing (2018, 700 pp.), ACM Platform for Advanced Scientific Computing Conference (2015, 250 pp.; 2016, 300 pp.; 2017, 350 pp.), International Workshop on Parallel Matrix Algorithms & Applications (2010, 2014, 2018; $\sim$ 150 pp.).
- Conference Steering Committees: ACM PASC (2018-), SIAM/SIAG SC Paper Proceedings (2019-).

I served on over 70 program committees of computer science conferences over the last ten years including all major conferences on computing such as IEEE International Parallel & Distributed Processing Symposium (2010, 2014, 2016-2020), ACM/IEEE Conference on High Performance Computing, Networking, Storage and Analysis SC (2008, 2010, 2013–2017, 2019).

10. Institutional responsibilities

- Director of Computational Science MS Program (since 01/2014), Director of Informatics and Computational Science PhD Program (since 09/2017), Examination Commission Faculty Hiring Committee (2016, 2018), Graduate Admissions Committee (since 01/2014),

11. Memberships in panels and boards, individual scientific reviewing activities (subset)

- Associate editor: ACM Transactions on Mathematical Software (2019-), SIAM Journal on Scientific Computing (2012–2018), Guest Editor Special Issue Parallel Computing (2012, 2014, 2016, 2018).
- SIAM/ACM/IEEE Service: Committee Chair SIAM SIAG/SC Best Paper Prize (2020), Editor-in-Chief Reappointment Committee for Computing in Science and Engineering (IEEE CiSE) (2019), Vice Chair of SIAM/SC Activity Group on Supercomputing (2018–2019), Committee Chair SIAM/SC Career Prize (2018), Committee Chair SIAM SIAG/CSE Best Paper Prize (2019), Program Director of SIAM/SC (2016—2017), Committee Chair SIAM SIAG/SC Best Paper Prize (2016).
- Advisory Boards: Computational Engineering M.S. at University of Erlangen-Nuremberg, Germany (2018-), Swiss Platform for Advanced Scientific Computing Core Program (PASC) (2017-), Project Leadership Team of PASC (2012–2016), Board Member Future Swiss Electrical Infrastructure (2013-).
- Regular grant reviewer for SNSF, PRACE, DFG, Gauss Centre for Supercomputing, Belgium Research Foundation, ETH, Czech Science Foundation, French National Research Agency.

12. Major Mathematical Software Effort (only sublist)

- PARDISO — Sparse Matrix Solver Software (author: Olaf Schenk). A fast multi-threaded sparse direct matrix solver software for arbitrary matrices. The software has been integrated into the Intel Math Kernel Library, it is used on a daily basis by over ten thousand of users and it is installed on every supercomputer from the TOP500 list. One paper related to the software has been cited over 1300 times. Available from http://www.pardiso-project.org (recent application papers: P3, P7).

13. Publication summary

Total (only last 10 years): 35 journal papers, 1 book, 6 book chapters, 29 top computer science conference papers, 5100+ citations, h-index: 29 (Google Scholar); Full publication list available at: http://usi.to/ovv

14. Funding

In 7 years at USI, my funding requests have been awarded over CHF 3.5 Mio including: SNF, DFG, CTI, Platform for Advanced Scientific Computing (PASC), EU-FP7, and industrial funding from IBM, NXP, and Intel. Full list of project is available at http://usi.to/ovv

Olaf Schenk – Research Output List (last ten years, selected list)

O. Schenk is an internationally visible and recognized expert of high-performance algorithms for scientific computing. He has performed research in various renowned places as ETH Zurich, IBM Thomas Watson Research Center, KIT, and other Swiss universities (University of Basel, USI). He is leading research projects in developing numerical algorithms and libraries for large-scale parallel machines. His research concerns algorithmic and architectural problems in the field of computational mathematics, scientific computing, and HPC with a strong emphasis on applications in computational science and data analytics. He is particularly interested in multi-core and many-core algorithms, as well as software for computational science and data analytics applications on emerging HPC architectures. To this end, his research connects several relevant subfields of computer science with the needs of computational science and HPC. He drives research toward extreme-scale computing in computational algorithms, application software, programming, and software tools. The results of this work are typically integrated into scientific codes that demonstrate the application-targeted use of these algorithms and programming models.

1. Selected peer-reviewed publications in scientific journals or conference proceedings

Total (only last 10 years): 35 journal papers, 1 book, 6 book chapters, 29 top computer science conference papers, 5100+ citations, h-index: 29 (Google Scholar); SIAM journals papers: > 10; full publication list available at: http://usi.to/ovv. The list below of ten selected papers demonstrate the various aspects of his research in computational mathematics, scientific computing, HPC software, and extreme-scale computing.

[P10] J. van Niekerk, H. Bakka, H. Rue, and O. Schenk. New frontiers in Bayesian modeling using the INLA package in R. **Journal of Statistical Software**, accepted, in press.

[P9] M. Bollhöfer, A. Eftekhari, S. Scheidegger, and O. Schenk. Large-scale sparse inverse covariance matrix estimation. **SIAM Journal on Scientific Computing**, 41(1):A380–A401, 2019.

[P8] A. Eftekhari, M. Bollhöfer, O. Schenk. Distributed memory sparse inverse covariance matrix estimation on HPC architectures. In **IEEE/ACM Proceedings of the International Conference for High Performance Computing, Networking, Storage & Analysis**, pp. 20:1–20:12, 2018.

[P7] A. De Coninck, B. De Baets, D. Kourounis, F. Verbosio, O. Schenk, S. Maenhout, and J. Fostier. Needles: Toward large-scale genomic prediction with marker-by-environment interaction. **Genetics**, 203(1):543–555, 2016.

[P6] J. Brumm, D. Mikushin, S. Scheidegger, and O. Schenk. Scalable high-dimensional dynamic stochastic economic modeling. **Journal of Computational Science**, 11:12 – 25, 2015.

[P5] G. Kollias, M. Sathe, O. Schenk, and A. Grama. Fast parallel algorithms for graph similarity and matching. **Journal of Parallel and Distributed Computing**, 74(5):2400 – 2410, 2014.

[P4] F. Curtis, O. Schenk, and A. Wächter. An interior-point algorithm for large-scale nonlinear optimization with inexact step computations. **SIAM Journal on Scientific Computing 32**, 6 (2010), 3447.

[P3] C. G. Petra, O. Schenk, M. Anitescu. Real-time stochastic optimization of complex energy systems on high-performance computers. **IEEE Computing in Science Engineering**, 16(5), Sep. 2014.

[P2] M. Christen, O. Schenk, and H. Burkhart. PATUS: A Code Generation and Autotuning Framework for Parallel Iterative Stencil Computations on Modern Microarchitectures. In **2011 IEEE International Parallel and Distributed Processing Symposium (IPDPS)**, pages 676–687, May 2011.

[P1] O. Schenk, M. Bollhöfer, and R. Römer. On large-scale diagonalization techniques for the Anderson model of localization. **SIAM Review 50**, 1 (2008), 91–112.

3. Books, or contributions to books

[B3] M. Bollhöfer, O. Schenk, R. Janalik, S. Hamm, K. Gullapalli. State-of-the-Art Sparse Direct Solvers. **Parallel Algorithms in Computational Science & Engineering**, Birkhauser, 2019, in press.

[B2] J. Kardos, D. Kourounis, and O. Schenk. Parallel Structure Exploiting Interior Point Methods. **Parallel Algorithms in Computational Science & Engineering**, Birkhauser, 2019, in press.

[B1] U. Naumann and O. Schenk. Combinatorial Scientific Computing. Chapman & Hall/CRC, 2012.

4. Patents and licenses

[P1] D. Kourounis and O. Schenk: *Method to Accelerate the Processing of Multiperiod Optimal Power Flow Problems*, EU PCT/EP2017/057632. Patent granted in USA/Europe (number pending, 2019)

5. Oral contributions to international conferences (selected list)

Only listing recent selected invited talks: Huawei European Research Symposium (Paris, 2019), ParNum workshop (keynote, Croatia, 2019); University of Zurich (2018); COSTNET Conference (keynote, Spain, 2019), ISC High Performance Conference (Germany, 2017); HPCSE (keynote, 2017, Czech Republic); International Symposium on Research and Education of Computational Science (keynote, 2017, Japan); University of Tokyo (2017, Japan); UBC Vancouver (2017, Canada); JST/CREST International Symposium on Post Petascale System Software (2017, Japan); HPCSE (keynote, 2015, Czech Republic); First Annual Meeting of Applied Mathematics (Taiwan, 2015); IBM T. Watson Research Center (2015, USA); University Geneva (2015); FAU Erlangen (Germany, 2015).

One example of his recent major research innovation is the design and implementation of a novel sparse **selected inversion factorization algorithm** applied to various applications from genomic predictions P7. He is the principal author of the popular sparse direct solver software PARDISO and recently initiated a connection to data analytics to advance the popular data-analytics R-INLA package P10 that provides a tool for computationally **efficient Bayesian modeling**. The swift uptake of this framework for Bayesian modeling is rooted in the computational efficiency of the approach and catalyzed by the growing demand in the Big Data era. It has also been used to extend a large study published in *Nature*, which concludes that fighting malaria in Africa has prevented nearly 700 million cases since 2000 (Bhatt et al., 2015). The study based on R-INLA made it to the **BBC News**[1] where the director general of the **World Health Organisation** (WHO), Dr. Margaret Chan, was interviewed and commented on it.

In many scientific computing applications, one has to deal with partitioning, elimination ordering, coloring, and matching problems for graphs and hypergraphs in various contexts. Together with his co-author Prof. Naumann he published in 2012 the **first book** on Combinatorial Scientific Computing that explores the latest research on creating algorithms and software tools to solve key combinatorial problems on large-scale HPC architectures. Such a combinatorial graph-theoretical approach enabled him in P1 to simulate an interior-eigenvalue problem in computational physics at a scale that was not possible before on high-performance architectures. This SIAM SISC paper was selected as a featured SIGEST paper in the **SIAM Review** on the basis of its **exceptional interest to the entire SIAM community**. In P4 he extended the graph matching algorithms from P1 to the solution of saddle-point problems in large-scale nonconvex interior-point optimization. This proposed algorithm and the linear solver reference implementation are now used in virtually every academic and industrial interior-point optimization implementation, such as in IPOPT (Wilkinson Prize for Numerical Software in 2011).

As part of his service activities for the research community he is delighted to transfer his research into teaching activities. For example, he was influential as an organizer in the set-up of the annual USI-CSCS Summer School on Efficient High-Performance Computing and Data Analytics and the Gene Golub SIAM Summer School on High-Performance Data Analytics. Both summer schools attracted high-qualified applications of over 150 PhD students each from all over the world in 2019. The short videos [2] could serve as an attractive way to disseminate the content of the program to a wider audience. He also has been coordinating the Swiss Platform for Advanced Scientific Computing (PASC)[3]. He played an instrumental role in initiating the new PASC conference series (as a chair for the first four conferences from 2014–2017 and now as a steering committee member). The PASC conference is now supported by ACM. In 2019, the conference set a new attendance record with 430 scientists, industry representatives, and experts present. Finally, he strongly supports the statement that "Without a close collaboration between applied mathematicians, computer scientists, and application scientists, we will not be able to develop a computational science discovery environment capable of exploiting the computational resources that will be available at the exascale (Quote from DOE report "Applied Mathematics Research for Exascale Computing", March 2014).

[1] `http://www.bbc.com/news/health-34260339`

[2] http://youtu.be/3enmB6hzBGM and https://youtu.be/ZBlXAaBHBUc (produced by Multimedia Services of ETH Zurich)

[3] [1] `http://www.pasc-ch.org/`