Curriculum Vitae

Personal Data

Full name	Priv.-Doz. Dipl.-Inf. Dr. Christoph Bernhard Koutschan
Date of birth	12.12.1978
Place of birth	Dillingen an der Donau, Germany
Nationality	German
Marital status	Married, two children

Contact

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Education and Work Experience

09/2018 –	Senior researcher at RICAM on a tenured position (after a positive evaluation by the Austrian Academy)
05/2017	Habilitation in Mathematics, Johannes Kepler University Linz, Austria. Thesis: *Quod Erat Demonstrandum: Proofs by Computer* (evaluation committee: James H. Davenport, Christian Krattenthaler, Marko Petkovšek, Bruno Salvy, Carsten Schneider, Nobuki Takayama)
09/2012 – 08/2018	Research scientist at the Johann Radon Institute for Computational and Applied Mathematics (RICAM), Linz, Austrian Academy of Sciences.
09/2011 – 08/2012	Postdoctoral researcher at Institut National de Recherche en Informatique et en Automatique (INRIA), MSR-INRIA Joint Centre, Orsay, France.
09/2010 – 08/2011	Postdoctoral researcher at the Research Institute for Symbolic Computation (RISC), Linz, Austria.
10/2009 – 06/2010	Postdoctoral researcher at Tulane University, New Orleans, USA.
10/2005 – 09/2009	Ph.D. studies in symbolic computation at RISC, Johannes Kepler University Linz, Austria. Ph.D. thesis: *Advanced Applications of the Holonomic Systems Approach* (advisor: Univ.-Prof. Dr. Peter Paule)
10/1999 – 07/2005	Undergraduate studies in computer science (minor subject: mathematics), Friedrich-Alexander University of Erlangen-Nürnberg, Germany.

Career-Related Activities

- Conference organization: PC member at ISSAC'16, ISSAC'17, DART8 (2017), SYNASC'18, FPSAC'19, ICMS'20, ISSAC'20, session organizer at ICMS'16, SCAS'16, ACA'17, ICMS'18, ICMS'20, organizer of several workshops, main organizer of the conference OPSFA15 (2019, 200 participants)
- Peer-Reviewing: 80 reviews for scientific journals and conferences, among them Journal of Symbolic Computation (9 reviews), Journal of Combinatorial Theory Series A, Inventiones Mathematicae, Journal of the LMS,Transactions of the AMS
- guest editor for the journals *Integral Transforms and Special Functions* and *Mathematics in Computer Science*
- Talks: 40 invited talks at international conferences, 9 contributed talks, and 20 invited colloquium talks
- Winner of the AMS David P. Robbins Prize (2016; together with Manuel Kauers and Doron Zeilberger)
- Third-party funding: *Certificate-free Summation and Integration* (SFB project part F 5011-N15, 2017 – 2021, 345,539 EUR), *Algebraic Statistics and Symbolic Computation* (FWF stand-alone project P 29467-N32, 2016 – 2018, 155,904 EUR)
- Author of various freely available open source software packages for Mathematica, for example the popular HolonomicFunctions package

Selected Publications

In total 64 publications in the period 2007–2020. The full texts of all publications are available at http://www.koutschan.de/publications.php.

- Shaoshi Chen, Christoph Koutschan. *Proof of the Wilf–Zeilberger conjecture for mixed hypergeometric terms.* Journal of Symbolic Computation **93**, pp. 133–147, 2019. DOI: 10.1016/j.jsc.2018.06.003, arXiv: 1507.04840.
- Jose Capco, Matteo Gallet, Georg Grasegger, Christoph Koutschan, Niels Lubbes, Josef Schicho. *The number of realizations of a Laman graph.* SIAM Journal on Applied Algebra and Geometry **2**(1), pp. 94–125, 2018. DOI: 10.1137/17M1118312, arXiv: 1701.05500.
- Shaoshi Chen, Mark van Hoeij, Manuel Kauers, Christoph Koutschan. *Reduction-based creative telescoping for fuchsian D-finite functions.* Journal of Symbolic Computation **85**, pp. 108–127, 2018. DOI: 10.1016/j.jsc.2017.07.005, arXiv: 1611.07421.
- Matteo Gallet, Christoph Koutschan, Zijia Li, Georg Regensburger, Josef Schicho, Nelly Villamizar. *Planar linkages following a prescribed motion.* Mathematics of Computation **86**, pp. 473–506, 2017. DOI: 10.1090/mcom/3120, arXiv: 1502.05623.
- Christoph Koutschan, Martin Neumüller, Cristian-Silviu Radu. *Inverse inequality estimates with symbolic computation.* Advances in Applied Mathematics **80**, pp. 1–23, 2016. DOI: 10.1016/j.aam.2016.04.005, arXiv: 1602.01304.
- Christoph Koutschan. *Lattice Green's functions of the higher-dimensional face-centered cubic lattices.* Journal of Physics A: Mathematical and Theoretical **46**(12), 125005, 2013. DOI: 10.1088/1751-8113/46/12/125005, arXiv: 1108.2164.
- Christoph Koutschan, Manuel Kauers, Doron Zeilberger. *Proof of George Andrews's and David Robbins's q-TSPP conjecture.* Proceedings of the National Academy of Sciences **108**(6), pp. 2196–2199, 2011. DOI: 10.1073/pnas.1019186108, arXiv: 1002.4384.
- Christoph Koutschan. *Advanced applications of the holonomic systems approach.* PhD thesis, Research Institute for Symbolic Computation (RISC), Johannes Kepler University, Linz, Austria, 2009.

Vision Statement

1 The field of Symbolic Computation

In the first issue of the Journal of Symbolic Computation, the founding editor Bruno Buchberger formulated a definition of the field, and nowadays, 35 years later, this definition is not at all outdated: in the broadest sense, Symbolic Computation deals with mathematical objects (numbers, polynomials, matrices, formulas, programs, rules, proofs, etc.) that can be represented in a computer in an exact manner, i.e., requiring only a finite amount of information. Symbolic Computation is concerned with designing algorithms in order to manipulate such objects in an effective and efficient way. Symbolic Computation is the bridge between mathematics and computer science. Informally speaking, the idea of Symbolic Computation is to "teach the computer to do mathematics".

The main sub-areas of symbolic computation are: exact arithmetic for numbers and polynomials, exact linear algebra and algorithms on matrices, polynomial systems, Gröbner bases and resultant methods, real root finding and homotopy methods, computational algebraic geometry, differential equations and differential algebra, symbolic summation and integration, recurrence equations, computational logic, quantifier elimination, computational group theory, complexity theory for algebraic algorithms, hybrid symbolic-numeric algorithms, and the development and advance of computer algebra systems.

Admittedly, some results in the field of Symbolic Computation are celebrated within this community but only for their own sake, e.g., a new algorithm for some classic problem, which despite having better complexity, will not be applicable to any real-world problem ever. However, the majority of researchers in Symbolic Computation care about applications of their work in other disciplines: this covers almost all areas of mathematics, for example calculus and complex analysis, combinatorics and graph theory, game theory, number theory, trigonometry and special functions, algebraic and differential geometry, dynamical systems, optimization, probability theory, cryptography, and control theory. Equally importantly, Symbolic Computation reaches out to other fields outside of mathematics, such as physics, biology, chemistry, engineering, and computer science. While it is essential to always emphasize this almost universal applicability of Symbolic Computation, it is conversely the case that research in Symbolic Computation is inspired by demands from all the above-mentioned fields. This interaction with so many other fields in science is something that has to be addressed and reflected in the Journal of Symbolic Computation.

Last but not least the role of Symbolic Computation in the mathematics and science education cannot be underestimated. Meanwhile, several generations of highschool students have used computer algebra systems in their math classes, and in the past years, the WolframAlpha website became a popular tool to assist them in their math assignments.

2 Scope of the Journal of Symbolic Computation

It is needless to say that the Journal of Symbolic Computation should be open to contributions from all the above-mentioned sub-areas of Symbolic Computation. In the past decades, a strong focus was laid on the mathematical foundations: new symbolic algorithms and complexity results, for example. In the future, more emphasis needs to be put also (1) on applications of Symbolic Computation and (2) particularly on software development.

Ad (1): It has been pointed out in the previous section, how many connections there are between Symbolic Computation and other fields inside and outside of mathematics. This rich network should also be reflected in the flagship of the field, the Journal of Symbolic Computation.

Ad (2): It is folkore that developing high-quality computer algebra software is very time-consuming and labor-intensive, but that it is very difficult to get proper scientific credit for this work, in terms of citations. The reason is that papers which present a new implementation of known algorithms may be rejected because of an alleged lack of novelty. Similarly to the software presentation track at ISSAC, the Journal of Symbolic Computation should provide a venue for communicating such work.

3 Organization of the Journal of Symbolic Computation

Manuscripts submitted to the Journal of Symbolic Computation need to be peer-reviewed according to the highest possible scientific standards, which means nothing but continuing the current code of practice. For each paper, there should be at least two referee reports, which in case of divergent recommendations should be supported by a third opinion. Care should be taken that the refereeing procedure is completed in a timely manner, e.g. by asking the referees to complete their report within 4–6 weeks. At the same time, the backlog of the journal has to be kept short. Ideally, the time between submission and publication should not exceed one year.

The current editorial board reads like the who-is-who in Symbolic Computation. It certainly endows the journal with an extremely high scientific reputation. At the same time, one should take care that also the younger generation of researchers in Symbolic Computation is represented adequately in the editorial board.

The role of the editor-in-chief is to represent the journal, to interact with the publishing company, to handle the submissions and distribute them among the members of the editorial board, and to be responsible for the final decisions concerning acceptance or rejection of a submitted manuscript. The editor-in-chief should organize regular meetings of the editorial board, e.g. on an annual basis and by video conference, in order to discuss possible issues and further strategic decisions of the journal. Apart from these special duties, the editor-in-chief should be viewed as a “primus inter pares”.

Traditionally (and rightly), the Journal of Symbolic Computation has very strong ties with the ISSAC conference. The communities that are addressed by JSC and ISSAC are anyway widely overlapping, and therefore it doesn't appear necessary to establish any kind of institutional relationship between the two, e.g. in the form of mutual memberships in editorial boards and steering committees.

In the past, many special issues of the JSC have been dedicated to conferences, most prominently related to the ISSAC conference series. Such special issues have to be organized with some caution, and in general, their number should be kept at a minimum. They delay the publication process of regularly submitted manuscripts and are endangered to publish incremental results.

4 Outlook for the field of Symbolic Computation and JSC

Symbolic Computation is not any more such a young field that it was when JSC was founded, but has reached a certain level of maturity. Nevertheless, it is still considered as a modern and emerging branch of mathematics. Being fluent in some computer algebra system can be considered as a core compentence of today's mathematicians. Such systems are an indispensable tool in their daily work, be it for executing some quick experiment, evaluating an integral, solving some linear or polynomial system, etc.

While nobody can seriously deny the importance of Symbolic Computation, care has to be taken that it receives sufficient visibility also outside its own field. Nowadays, "applied mathematics" is very fashionable and gets pushed in many respects: positions in research institutions, grant applications, etc. Often enough, the applications of Symbolic Computation are not directed immediately to real-life situations, but work in an indirect way: it supports other scientists in their research work. Hence, there is the latent danger that the relevance of Symbolic Computation gets underestimated by the public.

On the other hand, Symbolic Computation has the potential to play a key role in many research areas in the future. For example, a new trend is to utilize methods from machine learning in symbolic algorithms, and conversely, Symbolic Computation may contribute to a better understanding of AI. Another example are large compendia of mathematical knowledge, formerly published in book form (e.g., Abramowitz/Stegun: Handbook of Mathematical Functions) that nowadays are converted to electronic and online repositories (such as the NIST Digital Library of Mathematical Functions DLMF), whose functionality and usability can be greatly enhanced by the use of Symbolic Computation.

Motivation

Why do you want to become the editor of the Journal of Symbolic Computation?

I have been working in the field of Symbolic Computation for about 15 years and I am very interested in its diverse sub-areas. I have been supported by the symbolic computation community in many respects, so I am ready to give something back. It would be my pleasure and honor to serve the scientific community in the function of being editor of the Journal of Symbolic Computation.

Why are you enthusiastic about the journal?

JSC is the flagship journal in our field of Symbolic Computation. The editorial board reads as the who-is-who in symbolic computation and computer algebra. Together with the ISSAC conference, it is the main medium to communicate important research results in these areas. How can one not be enthusiastic about this journal?

What main changes and new ideas you want to implement when you become the editor?

My overall impression is that the journal is in a very good shape. I would like to make an effort to reduce the current backlog of the journal and to accelerate the publication process, i.e., reduce the time between submission and publication of an article. The number of special issues may be reduced.

What do you think could be your unique contributions to the development of the journal?

I strongly believe in the importance and relevance of Symbolic Computation. Therefore, the successful development of JSC is my heartfelt wish. I am ready to invest all my energy into editing this journal. Moreover, since I did my PhD at the Research Institute for Symbolic Computation (RISC), and now I'm working at the Austrian Academy of Sciences, in the vicinity of RISC, I can offer to bring JSC back to its roots in Linz, Austria.

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