INFORMATION, COMMUNICATION & COMPUTING

Fields of Expertise TU Graz

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Kay Uwe Römer,
Information, Communication & Computing
Source: Lunghammer – TU Graz

For the first time, an open-topic Field of Expertise tenure-track assistant professorship was opened, where candidates who work in one of the subfields of the Field of Expertise Information, Communication & Computing across all participating faculties could apply. We received 150 applications, many of them outstanding. One reviewer even congratulated us for such an impressive set of applications. The selection process was therefore very demanding, where a large selection committee with representatives from electrical engineering, informatics, and mathematics not only had to screen and assess 150 applications, but had to compare applicants across different disciplines, which was often not easy. In the end nine candidates were invited for interviews – this, too, was quite challenging as due to the Covid-19 situation a visit in person was not possible. We thus had a public talk and closed interview via the video conferencing platform WebEx, followed by individual online meetings of each applicant with members of the selection committee and representatives from different institutes, such that the candidates could get a good virtual impression of TU Graz and could decide to which institute and faculty they wish to be assigned. In the end, the highest ranked candidate accepted our offer and will join us in September 2021, filling a topic that was not well-represented at TU Graz before and which offers good opportunities for collaboration among all three faculties participating in the Field of Expertise Information, Communication & Computing. You will certainly hear more about the winner in September. Overall, these open-topic Field of Expertise tenure-track assistant professorships are introducing a very promising new instrument that allows us to attract top talent to TU Graz!

In this edition of TU Graz research, Manfred Kaltenbacher writes about his research. He recently joined the Institute of Fundamentals and Theory in Electrical Engineering as a full professor and head of institute. Enjoy reading!

Manfred Kaltenbacher

Modelling, Simulation and Optimization of Complex Technical and Medical Systems

In most cases the fabrication of prototypes within the design process is a lengthy and costly task, and reliable computer tools capable of precisely simulating the multi-field interactions are of utmost importance. Arbitrary modifications of geometry and selective variation of material parameters are easily performed, and the influence on behaviour can be studied immediately. In addition, simulation provides access to physical quantities that cannot be measured, e.g. the magnetic field in a solid body, and simulations strongly support insight into physical phenomena.

The modelling of complex technical as well as medical systems leads to so called multi-field problems, which are described by a system of nonlinear partial differential equations. The complexity consists of the simultaneous computation of the involved single fields as well as in the coupling terms, which in most cases introduce additional nonlinearities, e.g. moving/deforming conductive bodies within an electromagnetic field. For the efficient solution of these multi-field problems, we have developed an enhanced simulation environment based on the finite element (FE) method, which is continuously improved by new numerical schemes, advanced material models and coupling strategies. Just recently, we have transferred this software to free and open source under the MIT license, see https://opencfs.org. With a special focus on electromagnetics, structural mechanics, acoustics, and heat transfer, *openCFS* allows high-end computations of the following