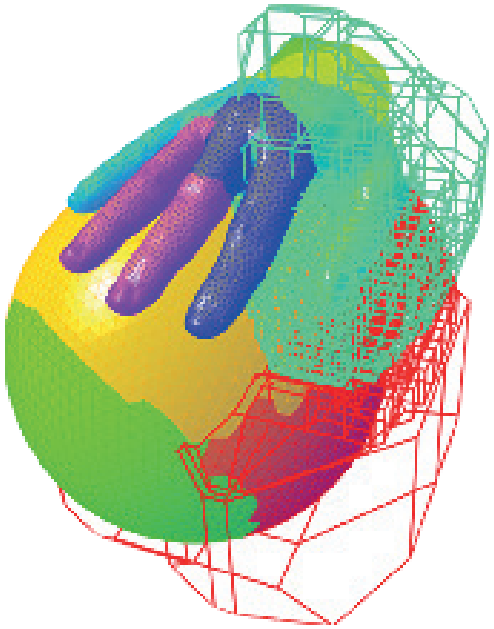
Berlin Mathematics Research Center MATH+

Berlin Mathematical School BMS

# MATH+ Friday Colloquium

## Friday 22 January 2021 at 14:15

Online (Zoom)



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## Rolf Krause

*(USI, Lugano)*


# Scales of knowledge

Complex coupled systems arise in medicine, science and engineering. Mathematically, these can be nonlinear coupled systems of PDEs or the nonconvex minimization problems found in deep learning. Progress has been driven by the mathematics of modeling, numerical simulation, data analysis and artificial intelligence, supported with ever increasing computational power. The resulting virtual models – discretized PDEs or trained networks – can be used for simulation, prediction and optimization. Many challenges remain, due to the richness of the systems' behavior across multiple scales.

In this talk, we show how multi-scale approaches give a mathematical technique for accurate and efficient simulation of complex systems. Using applications from cardiology, geothermal energy, engineering and deep learning, we will illustrate multi-scale decompositions and explain how mathematical ideas from approximation theory, optimization and numerics can also be used to exploit the capacities of modern supercomputers and specialized hardware through efficient parallel methods.

Rolf Krause holds a chair of advanced scientific computing in the Faculty of Informatics at Università della Svizzera Italiana (USI) and is the director of the Institute of Computational Science (ICS). He is also the Co-director of the Center for Computational Medicine in Cardiology (CCMC) at USI. From 2003 to 2009, he was professor for Scientific Computing at the University of Bonn. During that time he spent a sabbatical at UC San Diego (USA) and Columbia University New York (USA). In 2002 he was on a research visit at the Courant Institute (NYU, New York). He holds a Diploma and a PhD (2000) in Applied Mathematics from FU Berlin (Germany).

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