Seminar: Modeling, Algorithms, Simulation (WS20/21)

SCC

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Research Group "Computational Science and Mathematical Methods" (CSMM)

Methods of computational science are essential for modern research and development in science, technology and economy. Numerous examples can be found in the fields of fluid mechanics, climate research and materials research. The mathematical modeling and algorithms used here are the focus of this seminar. The practical relevance and the optimal use of the models and algorithms and, in particular, the applications of these models and algorithms in computer simulations for concrete scientific problems, are especially emphasized. On the one hand, the optimal choice and further development of models and algorithms can significantly increase the efficiency, accuracy and reliability of simulations on high-performance computers. On the other hand, the solution of completely new scientific tasks is often based on already known models and algorithms. The topics offered for the seminar are based on current research and include mathematical-physical modeling, numerical and non-numerical algorithms as well as other methodological areas of scientific computing.

On selected topics, the students investigate current approaches to modeling and algorithms used in modern computer simulation. Students learn about practical applications of different models and numerical and non-numerical algorithms in research and development. The students deepen their knowledge in the assigned topic and critically examine literature sources and existing implementations. In doing so they try to reconstruct key points of a concrete work (a paper or a simulation code). The students learn to present their assigned topics to the topic supervisors (the tutors) and other students in an understandable way and to answer questions in a subsequent discussion. Finally, the students will summarize their results in a written work (an article) and learn to write scientific texts.

Preliminary Topics

Analysis of ozone time series
High-order operator splitting approaches
Numerical propagators for classical and quantum mechanical systems
Particle swarm optimization
The phase field crystal model
Transport parameter determination for fusion energy research
Using neural networks in simulations, their training and optimization

Remarks

The pre-registration in ILIAS not later than 22.07.2020 18:00 is binding and obligatory. Please use the registration link or the QR code.

Registration for the seminar and topic assignments will take place during the introductory meeting on Thursday, 23.07.2020, from 13:00 to 14:00. We will inform all pre-registered students about the location of the introductory meeting (either a seminar room in 20.30 or an MS Teams link).

The presentations will be given in a block seminar at the end of the lecture period WS20/21. Depending on the number of participants a single day may be sufficient.

Language: German/English
Target Audience: Mathematics (Master) - Book under Mathematics (Master)
Kickoff Meeting: Thursday, 23.07.2020, from 13:00 to 14:00
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ILIAS Link: https://ilias.studium.kit.edu/goto_produktiv_crs_1220653.html

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