

TU Berlin
Advanced Topics from Scientific Computing
Winter Semester 2022/2023

Slide lecture 1

Jürgen Fuhrmann

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- Course homepage:
<https://www.wias-berlin.de/people/fuhrmann/AdSciComp-WS2223/>
- Experience/Field of work:
 - Numerical solution of partial differential equations (PDEs)
 - Development, investigation, implementation of finite volume discretizations for nonlinear systems of PDEs
 - Ph.D. on multigrid methods
 - Applications: electrochemistry, semiconductor physics, groundwater...
 - Software development:
 - WIAS code pdelib (<http://pdelib.org>)
 - Julia PDE solver package VoronoiFVM.jl (<http://github.com/j-fu/VoronoiFVM.jl>) + package environment
 - Languages: C, C++, Python, Lua, Fortran, Julia
 - Visualization: OpenGL, VTK

- Lectures will be recorded
- Lecture material will be available via <https://www.wias-berlin.de/people/fuhrmann/AdSciComp-WS2223/>
- All code examples and project assignments will be in Julia, either as notebooks or as Julia files. Things should work on Linux, MacOSX, Windows
- Assignments and course projects will given to groups of three
- Examinations will be based on coding projects

- Introduction to Julia as fresh approach to combine efficient computation with easy composability
- Focus on partial differential equation (PDE) solution
 - Solution of large linear systems of equations
 - Finite element and finite volume methods
 - Mesh generation
 - Nonlinear solvers
 - Automatic differentiation
 - Aspects of parallelization, Visualization
- Elements of Scientific Computing not covered:
 - Stochastic methods
 - Machine learning