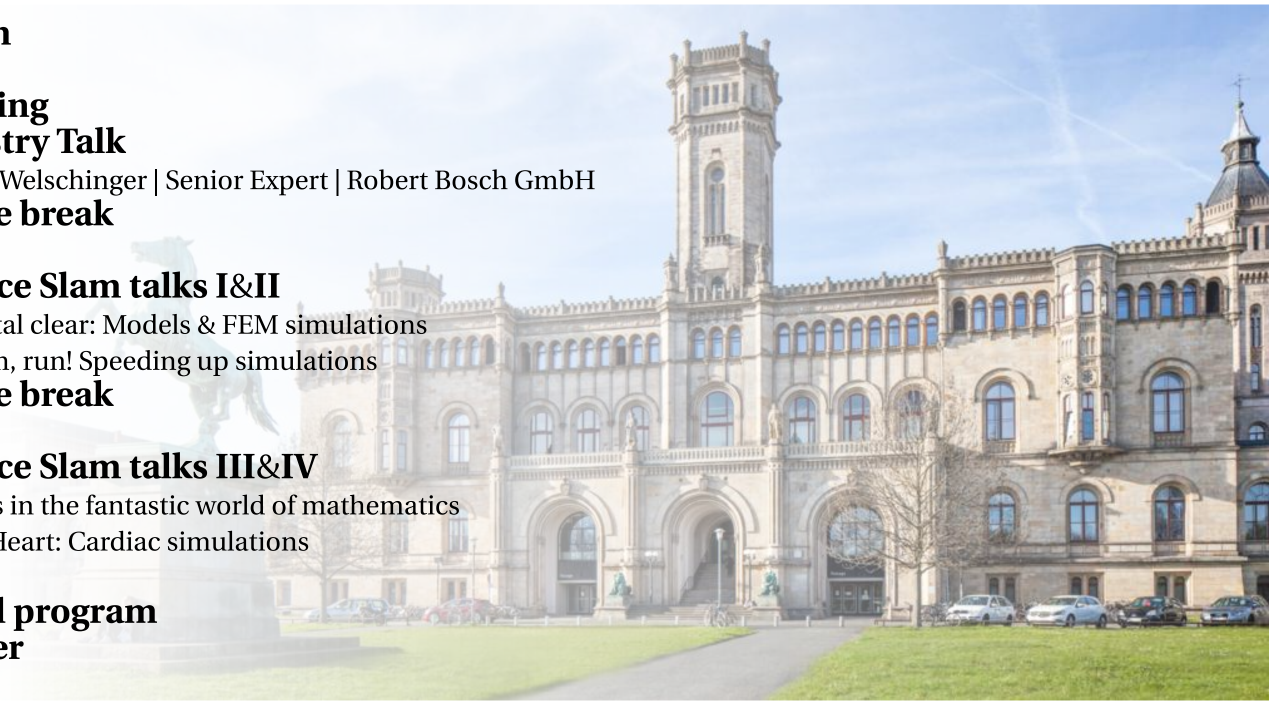
GAMM Student Chapter Science Slam - Program



11:45 Lunch

12:45 Opening
13:00 Industry Talk
Dr.-Ing. Fabian Welschinger | Senior Expert | Robert Bosch GmbH
14:00 Coffee break

14:15 Science Slam talks I&II
- Elasticity crystal clear: Models & FEM simulations
- Run, algorithm, run! Speeding up simulations

15:20 Coffee break

15:45 Science Slam talks III&IV
- Infinite battles in the fantastic world of mathematics
- Affairs of the Heart: Cardiac simulations

17:00 Social program
18:30 Dinner

Science Slam talks - Detailed Program

I. Elasticity crystal clear: Models & FEM simulations

1.) **A model for the evolution size and composition of olivine crystals**
Henrik Haddenhorst, Ruhr-University Bochum
In this presentation, we introduce a material model to describe the evolution of olivine crystals, in particular iron-based Fayalite crystals, which are affected by the diffusion of magnesium ions. The model describes the development of the dislocation density, the concentration of magnesium over location and time, as well as the development of the size of the crystal over time. We discuss the derivation of the model and the corresponding parameters.

2.) **Derivation and simulation of thermoelastic Kirchhoff plates**
Johanna Beier, Leibniz-University Hannover
Within the research of the Cluster of Excellence PhoenixD it is of interest to simulate thermoelastic materials on thin optical components which have the structure of Kirchhoff-Plates. In this talk I will present a short derivation of the underlying equations and how we modify them for better numerical treatment. Further I will show our finite element simulation results.

3.) **Numerical Solution of Finite Element Problems in Elasticity**
Lina Fesefeldt, Hamburg University of Technology
Usually, Newton's method is used to compute the stress and deformation fields of elastic materials. This requires the highly expensive computation of a Jacobian. The big question is: What can we do to reduce computational effort while still producing accurate results for the deformation and stress fields?

II. Run, algorithm, run! Speeding up simulations

4.) **Solving meshless PDE discretizations using multicloud techniques**
Thorben Abel, Hamburg University of Technology
We want to solve the linear systems that arise from meshless PDE discretization. To make this applicable to large systems our goal is to solve them in linear time ($\mathcal{O}(n)$). To achieve this we combine the techniques used in RBF-FD and in multigrid methods.

5.) **How deep is the river?**
Judith Angel, Hamburg University of Technology
Direct measurements of the bottom of a river can be costly. In this talk, a way to compute this numerically, will be presented. We show how the Parareal algorithm can speed up those computations.

III. Infinite battles in the fantastic world of mathematics

6.) **Fantastic sets and where to find them**
Eleonora Ficola, University of Hamburg
At the border between Analysis and Geometry lies...Geometric Measure Theory! In this short talk I will introduce you to this seemingly far-from-reality branch of Mathematics and discuss classical results as well as interesting open problems.

7.) **Spectra of Periodic Quantum Graphs: An epic battle of simplifying determinants**
Dennis Schmeckpeper, Hamburg University of Technology
Quantum graphs can be viewed as intervals glued together to form a graph-like structure. Each quantum graph possesses a distinctive operator, such as the Laplacian, which operates on the intervals and fulfills compatibility conditions. By exploiting the inherent periodicities within the graphs, the eigenvalues of the Laplacian can be precisely identified as those for which the determinant of a certain system matrix vanishes.

8.) **Shape Optimization for Runaways: Is 4.1 Infinite?**
Henrik Wyschka, University of Hamburg
We consider the optimization of obstacles in Stokes flow. Questions to address here are the choice of suitable spaces, suspicious approximations, and the never-ending quest for the right deformations of computational meshes. (No engineers will be harmed during the talk.)

IV. Affairs of the Heart: Cardiac simulations

9.) **Modelling the effect of anti hypertensive drugs on arteries**
Sharan Nurani Ramesh, Ruhr-University Bochum
Hypertension affects 7 out 10 people above the age of 65, and is treated using antihypertensive drugs. However, in certain situations, their use has been linked to strokes. We try to numerically simulate arteries under drug influence to better understand their behaviour and eventually help in medical decision making.

10.) **Making the Heart Beat Faster: Space-Time Adaptive Simulations of Cardiac Electrophysiology**
Dennis Ogiermann, Ruhr-University Bochum
Computer simulations of heart tissue have gained much attention in the last decade, especially due to their success stories for clinical and pharmacological applications. Performing such simulations on realistic time scales is still considered to be a privilege of those who have access to large clusters and can afford the associated electricity bill. I will show you that a combinations of adaptive mesh refinement in tandem with time step length adaptivity techniques can drastically reduce the required compute power on a road to making heart simulations affordable for everyone.