Chair of Numerical Mathematics
TUM School of Computation, Information and Technology
Technische Universität München

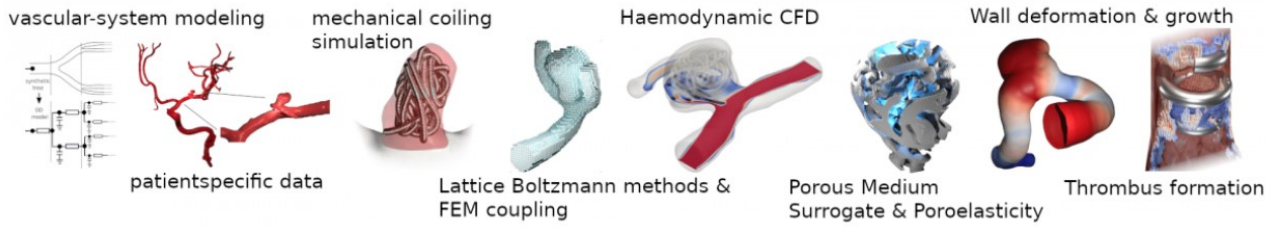
The TUM School of Computation, Information and Technology at the Technical University of Munich (TUM) welcomes applications for a

PhD or Postdoc Position in Numerical Mathematics
m/f/d, 100%, 2 years+

Field of Research: Multiphysics Simulation of Hemodynamics, Treatment, and Long-Term Perspective of Cerebral Aneurysms Using Lattice Boltzmann Methods.

As part of the second phase of the DFG funded Priority Programme **SPP2311**, the Chair of Numerical Mathematics under the leadership of Frau Prof. Dr. Barbara Wohlmuth is seeking a candidate for a PhD or postdoctoral position (100%) within the above named field of research. The position is initially for 2 years with extensions possible depending on project extension and / or personal performance.

Candidates should have an interest in applied mathematics, programming experience, and a passion for a practice-oriented project involving real data and applications.



Project Outline

The project focuses on the numerical simulation of blood flow within cerebral aneurysms. Arterial geometries are derived from medical scans (e.g., CT) of real patients, which are suitably meshed and processed for numerical treatment using Lattice-Boltzmann methods (LBM). For fluid simulations, we utilize the high-performance LBM framework waLBerla, predominantly written in C++, but increasingly adapted for GPU computations through automatic code generation using Python scripts. In addition to simulating the current state of an aneurysm, the project also examines the long-term outcomes of treatments, including coiling devices, medical micro-wires inserted into the aneurysm, where they coil up and ultimately seal off the aneurysm from blood flow. Aspects such as thrombus formation, inflammatory processes in the vessel wall, and its pulsation are as significant as post-implantation deformations of the devices and their influence on blood flow dynamics. Alongside computationally intensive, fully resolved simulations, the project employs porous media surrogate models and their LBM implementation. Given that numerous measurements and parameters are subject to uncertainties, the project also incorporates uncertainty quantification (UQ) with the ultimate goal of providing at least statistical insights into the risks and success rates of real, patient-specific aneurysms, their treatment options, and long-term prognosis. The project is complemented by contributions in machine learning, such as the rapid generation of realistic implant geometries or the learning of biomedical parameters from experimental or clinical datasets.

Further information can be found on our websites:
https://www.math.cit.tum.de/math/forschung/gruppen/numerical-analysis/

and https://www.spp2311.de/research-projects/ specifically https://www.spp2311.de/projekte/in-stent-restenosis-in-coronary-arteries-in-silico-investigations-based-on-patient-specific-clinical-data-and-meta-modeling-5/

Responsibilities:
Specific tasks within the project include

- Mathematical derivation, analysis, and comparison of models, methods, and simulation approaches.
- Rapid prototyping of new ideas in custom code.
- Implementation of new models, methods, and algorithms into an existing framework, with a focus on efficiency.
- Creation and execution of relevant simulation pipelines: from real data to mathematical and clinically actionable results.
- Publication of results in the scientific community (journals, conference contributions, lecture presentations, etc.) in English.

Requirements:

- A completed degree (Master's) in Applied Mathematics, CSE, or comparable programs with above-average results.
- Good programming skills and experience in C++ and Python.
- Knowledge (acquired during a Master's program / Dissertation) in numerical methods and simulation, particularly for partial differential equations.
- Basic knowledge in mathematical modeling with/and partial differential equations, with a focus on fluid or biomechanics, porous media.
- Optional/advantageous: Experience with Lattice-Boltzmann methods and their implementation, as well as high-performance computing experience.
- A solid command of English in speaking and writing. Knowledge of German is not required.

We offer:

- a dynamic and international team of scientists from various disciplines, as well as collaboration with international partners
- a young and ambitious research environment at an internationally renowned university with good connections to some of the leading research institutes and industry participants worldwide
- An exciting and diverse project within a nationwide research network with numerous opportunities for development.
- Modern hardware and infrastructure at the workplace, ranging from compute and GPU servers to supercomputers.
- Project-based work towards a doctoral degree (Dr. rer. nat.) at TUM based on the project topic.
- Salary based on the Collective Agreement for the Civil Service of the Länder (TV-L) up to TV-L13. The actual salary depends on academic experience, tax classification etc.

TUM strives to raise the proportion of women in its workforce and explicitly encourages applications from qualified women. The position is suitable for disabled persons. Disabled applicants will be given preference in case of generally equivalent suitability, aptitude and professional performance.

Application:

Have we sparked your interest in the project and the position?
Then please apply to Prof. Dr. Barbara Wohlmuth with reference to this job posting by **Monday, March 10th, 2025** with the following documents:

- a compelling cover-letter
- your CV
- your final transcript of records from your most recent educational phase (e.g., degree or Ph.D.).
- if you have relevant publications (or, for example, a Master's thesis) that you would like to be considered as part of your application, please include these also (preferably as a weblink).
- name, affiliation and email address of a person willing and authorized to send us a recommendation on direct request. Please do not send any letters of recommendation with you application.

Via email to: **office@nm.cit.tum.de**
Please state "Application SPP2311" in the Email header, and send the documents as a single PDF file.

Data protection: *As part of your application for a position at the Technical University of Munich (TUM), you will submit personal data. Please take note of our privacy notice in accordance with Art. 13 of the Datenschutz-Grundverordnung (DSGVO) regarding the collection and processing of personal data in the context of your application: https://portal.mytum.de/kompass/datenschutz/Bewerbung/*
By submitting your application, you confirm that you have read and understood TUM's privacy notice.