

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

Postdoctoral Researcher in numerical mathematics / computer science (m/f/d, 100%)

The BMBF-funded position is located within the research project **Multiphysics simulations for geodynamics on heterogeneous exascale systems** at the Chair of Numerical Analysis, led by Prof. Dr. Barbara Wohlmuth in the TUM Department of Mathematics. We seek a postdoctoral researcher, with starting date as soon as possible.

This is a 100% position at German Civil Service salary level TV-L E13, and is financed initially until October 2025 with a possibility of extension. The position carries no teaching load.

Project Summary

The research project **Multiphysics simulations for geodynamics on heterogeneous exascale systems** is a multidisciplinary project combining the fields of mathematics, computer science, geophysics, and high-performance computing. Each field is represented by a dedicated project partner, which brings in their experience. These are the Chair of Numerical Analysis at TUM, the Chair of System Simulation at FAU Erlangen, the Chair of Geophysics at LMU München, and finally, the LRZ Garching with their knowledge about supercomputers.

Firstly, the project aims to improve the performance of the matrix-free finite-element-based framework HyTeG, in particular by techniques for data reduction through surrogate operators. Furthermore, we aim to extend the framework with mixed-precision approaches, which will be implemented and analyzed.

Secondly, we aim at a volume coupling of the high-performance packages waLBerla, HyTeG, and MesaPD to solve complex multiphysics problems. The coupling is done across package boundaries. This also requires more sophisticated approaches in load-balancing.

Finally, the newly developed algorithms will be tested and verified with applications from geodynamics.

Tasks in the project include

- the efficient implementation of new models, methods, and algorithms into existing *high-performance* frameworks,
- the fast prototyping of new ideas in individual code,
- an interest in the entire simulation pipeline: starting from simple algorithms to state-of-the-art applications in geophysics executed on supercomputers,
- as well as the presentation of the results to the scientific community in journals, at conferences, and as lecture contributions for students.

Requirements for the position:

- A Ph.D. in the field of Applied Mathematics, Computer Science, Computational Science and Engineering, or similar.
- a strong background **either** in high-performance computing **or** in numerical analysis.
- Knowledge of numerics as part of a degree program. In particular, knowledge about **finite-element analysis** is an absolute *must*. Familiarity with *iterative solvers*, *preconditioners*, *multigrid methods*, and

mixed-precision approaches is optional but extremely useful.

- Good programming skills and experience in **C++** and its common programming *idioms* and *design patterns*. Knowledge of MATLAB, Python, Julia, or a similar scripting language is necessary for prototyping.
- Interest and affinity for **high-performance computing**. You should have experience with the *roofline model* and familiarity with a *profiler*. Experience with *GPUs* is a bonus.
- Fluency in written and spoken *English*. German language skills are not a prerequisite for the position.

We offer

- a position within a young, dynamic, and international team of scientists from various disciplines, as well as cooperation with international partners,
- an exciting and varied project with many different aspects and possibilities for expansion,
- modern hardware and infrastructure at the workplace, from compute- and GPU servers to supercomputers,
- a salary according to the German civil service rates (TV-L, level E13), and
- the environment of a renowned and modern university in a beautiful city close to the Alps.

For any questions regarding the position, please do not hesitate to contact Andreas Wagner:

wagneran@cit.tum.de

Applications should include

- a letter of application, explaining the applicant's interest in the position as well as their relevant skills and experience
- a curriculum vitae,
- a list of relevant publications, for instance, your Ph.D. thesis, with links to the publications.
- names and email addresses of two professors that may provide letters of recommendation directly to the hiring committee

Applications should be sent as a **single PDF document** via **email** to Prof. Dr. Barbara Wohlmuth: wohlmuth@cit.tum.de. Please state "Application: **Multiphysics**" in the subject line.

Review of applications will begin on **February 28, 2023**. Applications received after this date will still be considered if the position is not yet filled.

The Technical University of Munich is an equal opportunity employer. As such, applications from women are explicitly encouraged. Preference will be given to candidates with disabilities who have essentially the same qualifications.

* As part of your application, you provide personal data to the Technical University of Munich (TUM). Please view our privacy policy on collecting and processing personal data in the course of the application process pursuant to Art. 13 of the General Data Protection Regulation of the European Union (GDPR) at <https://portal.mytum.de/kompass/datenschutz/Bewerbung/>. By submitting your application, you confirm to have read and understood the data protection information provided by TUM.