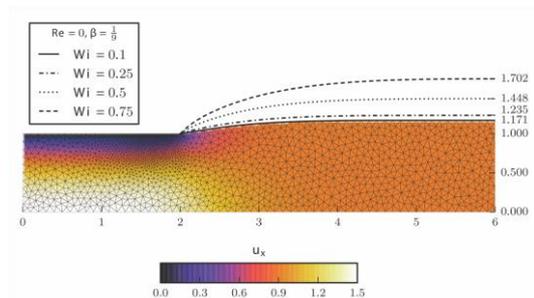


## PhD project: Neural networks as reduced models for high-fidelity flow simulations in bioreactors and energy-efficient manufacturing processes

The Helmholtz School for Data Science in Life, Earth and Energy (HDS-LEE) provides an interdisciplinary environment for educating the next generation of data scientists in close contact to domain-specific knowledge and research. All three domains – life & medical sciences, earth sciences, and energy systems/materials – are characterized by the generation of huge heterogeneously structured data sets, which have to be evaluated in order to obtain a holistic understanding of very complex systems. Visit HDS-LEE at: [www.hds-lee.de](http://www.hds-lee.de)

### Project overview

The Chair for Computational Analysis of Technical Systems at the Faculty of Mechanical Engineering of the RWTH Aachen University seeks a scientific co-worker in various areas of incompressible fluid flow modeling, simulation, optimization, and scientific computing. The candidate is expected to conduct research leading to a doctoral thesis. The position is offered jointly with the Excellence Cluster 2023 "Internet of Production" and involves dual application topics:



Numerical Design of Manufacturing Processes: Current numerical design of manufacturing processes is based on a digital twin simulation of the process machines. This digital twin is, however, not suitable to support real-time decision-making directly at the machine; the digital shadow is based on a reduced simulation model, initially based on parameterized partial differential equations, which focuses on only currently relevant aspects. An important addition will be the development of error estimators that quantify the variation between the reduced models and the fully-resolved models in order to automatically determine the level of approximation.

Biotechnology Processes Involving Reactors: Building on recent efforts in the computational fluid dynamics community augmenting classical model reduction with machine learning, we will explore the combination of POD-type methods and artificial neural networks as an efficient and automated way of generating reduced models for high-fidelity fluid flow simulations. The developed concepts will be applied to biotechnology processes involving reactors.

### Your profile

- Master's degree in computational or mechanical engineering, applied mathematics, or a similar subject with a superior academic record.
- Practical programming experience in Fortran, C, or C++ as well as with parallelization (MPI or OpenMP) are of advantage.
- Familiarity with UNIX operating systems would be ideal.
- We expect you to contribute to general tasks at the institute, such as teaching and advising master or project theses.
- Language skills in German are not required.
- Excellent communication skills in English are mandatory: TOEFL or equivalent evidence of English-speaking skills
- A high level of scholarship as indicated, for example, by bachelor and master study transcripts and two reference letters
- Outstanding organizational skills and the ability to work independently
- Very good cooperation and communication skills and ability to work as part of a team

**Our offer**

The candidate will be employed as a regular employee and must meet required personal qualifications. This is a full-time position with salary according to German civil service pay scale TV-L E 13 (roughly 3600 euros/month before taxes). The expected appointment period is up to five years, with an initial appointment for one year.

At our chair, we consider serious and reliable research an important task. At the same time, we can offer you to become part of a very social and well-functioning team of currently roughly 20 members. Especially for international students, open doors and regular social events help become acquainted with the German culture quickly. Furthermore, we can assure you that we will support your personal development in all ways possible, thus giving you a good starting point for a future career in both academia or industry. Feel free to contact us for further information!

The HDS-LEE graduate school offers

- Unique graduate school program
- Chance of participating in (international) conferences
- Continuous scientific mentoring by your scientific advisor
- Further development of your personal strengths, e.g. via a comprehensive further training program

Apply to and contact for further information: Stefanie Elgeti, phone +49 241 80 99922,  
[elgeti@cats.rwth-aachen.de](mailto:elgeti@cats.rwth-aachen.de)

Apply until: 31<sup>th</sup> May 2019

Starting date: July 2019