

Felix Köhler

Computational Scientist & Machine Learning Researcher



I am an experienced software engineer with a passion for high-performance numerical computing as it is found in Computational Science and Machine Learning. Throughout my studies, I obtained a deep understanding of various simulation techniques, became proficient in advanced mathematical concepts, used Machine Learning in practical applications and acquired domain knowledge in Mechanical Engineering (Fluid & Structural Mechanics). I am driven towards solving tough problems that require working with state-of-the-art technology. And over the last years, I was part in research that led to one publication ([2]) and an invention disclosure. On my YouTube Channel (>9000 subscribers) I provide free education on Machine Learning & Simulation.

EDUCATION

PHD MACHINE LEARNING IN PHYSICS SIMULATIONS | TU MUNICH

since Sept 2022 | Munich, Germany

- Research on automatic differentiation and adjoint methods in physics simulations, inverse problems and optimization algorithms

M.SC. COMPUTATIONAL SCIENCE AND ENGINEERING | TU MUNICH

GPA: 1.2 | Best 2% | Coursework fully in English | October 2019 – April 2022 | Munich, Germany

- Master Thesis: 'Machine Learning accelerated Computational Fluid Dynamics' in collaboration with Siemens supervised by Dr. Dirk Hartmann
- Relevant Courses: Numerical Analysis, Parallel Programming [1], High-Performance Computing, Parallel Numerics, Scientific Computing, ML for Graphs & Sequential Data, Uncertainty Quantification

EXCHANGE MACHINE LEARNING & TECHNICAL COMPUTING | KTH

GPA: A | Coursework fully in English | August 2020 – January 2021 | Stockholm, Sweden

- Relevant Courses: Machine Learning, Probabilistic Machine Learning, Visualization, Nonlinear Finite Element Method, Computational Plasticity

B.SC. MECHANICAL ENGINEERING | TU BRAUNSCHWEIG

GPA: 1.1 | graduated with honors | October 2015 – March 2019 | Braunschweig, Germany

EXPERIENCE

WORKING STUDENT SIMULATION & DIGITAL TWINS | SIEMENS

March 2020 – April 2022 | Munich, Germany

- Machine Learning based extraction of explicit control heuristics out of nonlinear Model-Predictive Controllers primarily with SciKit-Learn
- Large-Scale Task Automation for HPC using dask in Python
- Invention disclosure on the involved Symbolic Regression

RESEARCH ENGINEER | TUM HYPERLOOP

November 2019 – June 2020 | Munich, Germany

- Simulation of electromagnetic levitation using ANSYS Maxwell
- Multiphysics simulation coupling and design optimization
- Working with the HPC systems of the Leibniz Supercomputing Center

INTERN SIMULATION ENGINEER & SOFTWARE ENGINEER | VOLKSWAGEN

October 2018 – March 2019 | Braunschweig, Germany

- Chassis simulation and design as well as software engineering for the in-house topology optimization suite resulting in up to 40% additional weight reduction in the tested examples [2]

SKILLS

PROGRAMMING

Proficient:
C++ • Python • Julia

Experienced:
MATLAB • FORTRAN • Bash

LIBRARIES/FRAMEWORKS

JAX • TensorFlow 2 • TensorFlow Probability • SciPy • Eigen • OpenMP • MPI • Streamlit • SciKit-Learn • Pandas

TOOLS/PLATFORMS

Linux • Git • Docker • OpenFoam • Paraview • ANSYS Maxwell • Amesim

LANGUAGES

German (Native)
English (Proficient), 8.5/9.0 (IELTS)
French & Swedish (Elementary)

AWARDS

Studienstiftung des Deutschen Volkes, 2020

Deutschlandstipendium, 2015, 2017, 2019

TEACHING ASSIST.

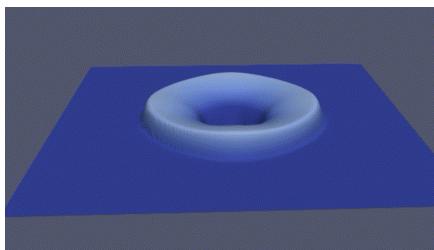
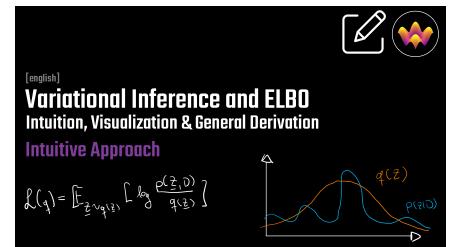
Partial Differential Equations, Vector Calculus: 2017, 2018
Heat & Mass Transfer: 2018
Thermodynamics: 2017
Linear Algebra, Multivariate Calculus, Ordinary Differential Equations: 2016, 2017

PROJECTS & PUBLICATIONS

MACHINE LEARNING & SIMULATION | YOUTUBE CHANNEL

February 2021 – current

- Teaching advanced mathematical topics using hand-written notes, visualizations and simple implementations in Python or Julia
- Topics: (Probabilistic) Machine Learning, Optimization, Continuum Mechanics, Numerical Linear Algebra, Computational Fluid Dynamics, Adjoint Methods and Automatic Differentiation
- more than 9000 subscribers and more than 300,000 video views



[1] TSUNAMIS.JL | CSE SEMINAR

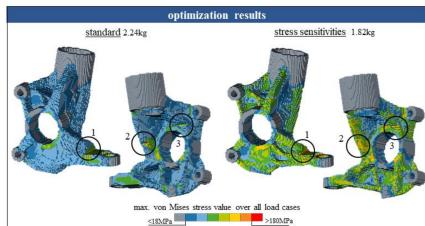
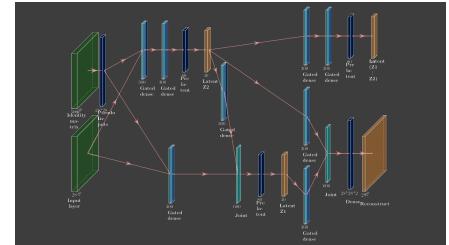
April 2020 – June 2020

- Translation of a parallel Shallow Water Equations code with the Finite Volume Method and a HLLE Riemann solver to Julia
- Code optimization and parallelization using Julia's built-in functionality
- Weak Scaling analysis using the Leibniz Supercomputing Center
- Link to the GitHub Repository and corresponding paper

VARIATIONAL AUTOENCODER WITH VAMPPRIOR | PROJECT WORK

November 2020 – January 2021

- Re-Implementation and analysis of VAE with a VampPrior in TensorFlow Probability
- Testing the performance of the Deep Learning model on MNIST, OMNIGLOT and Caltech 101 datasets
- Link to the GitHub Repository and the corresponding paper



[2] ADJOINT SENSITIVITIES IN TOPOLOGY OPTIMIZATION | RESEARCH

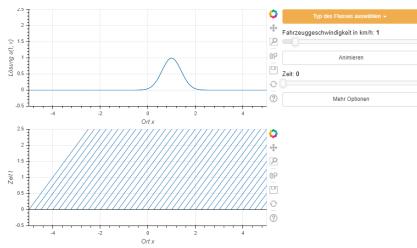
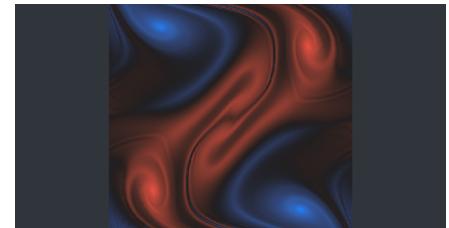
October 2018 – March 2019

- Extension of a heuristics-based topology optimization in C++ by loss sensitivities obtained through solving an adjoint Finite Element problem
- Validation using standard L-bracket test as well as a realistic Volkswagen three-dimensional steering knuckle including a casting simulation
- Link to the paper that was presented at the 13th World Congress on Structural and Multidisciplinary Optimization, WCSMO-13, 2019

STABLE FLUIDS IN JULIA | HOBBY PROJECT

January 2021

- Implementation of Jos Stam's stable fluids algorithm with the FTT in the Julia Programming Language
- Creation of coding tutorials for my YouTube channel, here and here
- Link to the GitHub Repository



EXPLORATORY MATHEMATICS | TEACHING ASSISTANT POSITION

October 2018 – September 2019

- Interactive Web application to visually teach concepts in undergraduate engineering mathematics (linear algebra, differential equations etc.)
- Full-Stack development using flask and bokeh
- Link to the GitHub Repository