

Dr.-Ing. Khaled Boulbrachene



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Professional Summary

CFD engineer with a Dr.-Ing. in Computational Fluid Dynamics and over six years of experience developing and implementing numerical methods for high-fidelity CFD solvers. Expertise in numerical methods, scientific software development, parallel programming, and high-performance computing for large-scale engineering simulations.

Work Experience

- June 2020 – Present **Research Associate**, *Helmut Schmidt University/University of the Federal Armed Forces*, Hamburg, Department of Fluid Mechanics
- Developed and implemented numerical methods for imposing discrete wind gusts within a fully parallelized 3D finite-volume Navier–Stokes solver.
 - Implemented the immersed boundary method for uniform Cartesian and non-uniform curvilinear grids, enabling efficient simulation of rigid bodies undergoing large displacements.
 - Implemented MPI-based parallel communication routines required by the immersed boundary method for efficient data exchange across decomposed computational domains.
 - Validated the implemented methods against benchmark cases and experimental data.
 - Applied the implemented methods to simulate rigid-body configurations and fully coupled fluid–structure interaction problems.
 - Automated large-scale MPI simulations on HPC clusters using Bash and SLURM scripts.
 - Published six peer-reviewed journal articles based on the developed methods.
- June 2019 – March 2020 **Working Student**, *Mecuris GmbH*, Munich, Quality Assurance Team
- Performed finite element analyses of 3D-printed prosthetic feet using ANSYS Workbench.
 - Evaluated stress distributions in prosthetic feet for virtual quality assurance.
 - Applied ANSYS optiSLang with Metamodels of Optimal Prognosis (MOP) to rapidly predict prosthetic foot structural response.
 - Implemented an efficient MOP-based decision workflow for selecting appropriate prosthetic feet based on patient-specific parameters.
- Nov. 2018 – Apr. 2019 **Student Research Assistant**, *Technical University of Munich*, Munich, Chair of Structural Mechanics
- Developed an interactive Python/Bokeh web application for computing and visualizing continuous wavelet transforms ([Live App](#)).
 - Enhanced a Python/Bokeh web application for simulating and visualizing the dynamic response of a base-excited mass–spring–damper system ([Live App](#)).
- March 2017 – May 2017 **Researcher**, *Qatar University*, Doha, Department of Chemistry and Earth Sciences
- Derived the coupled nonlinear equations governing lateral and torsional vibrations in horizontal drill pipes using Lagrange’s equations.
 - Implemented the numerical solution in MATLAB and analyzed the resulting dynamic system.

Education

- June 2020 – May 2026 **Doctorate in Engineering (Dr.-Ing.)**, *Helmut Schmidt University/University of the Federal Armed Forces*, Hamburg
Dissertation title: “*Numerical simulation of turbulent wind gusts and their dynamic effects on flexible structures*”.
Final grade: Magna cumme laude
- Oct. 2017 – Jan. 2020 **M.Sc., Computational Mechanics**, *Technical University of Munich*, Munich
Master thesis: “*Implementation of an immersed boundary method for a fourth-order finite volume scheme*”.
Final grade: 1.6/1.0
- Sep. 2011 – June. 2016 **B.Eng., Mechanical Engineering**, *Sultan Qaboos University*, Muscat
Bachelor thesis: “*Design and fabrication of an experimental setup to investigate fatigue failure in drilling pipes*”.
Final grade: 3.7/4.0

Skills

Languages	Arabic (native), English (C1–Professional), German (B2)
Programming	Fortran, C++, Python, MATLAB, Bash
Numerical Methods	Finite Volume Method (FVM), Finite Element Method (FEM), Arbitrary Lagrangian–Eulerian (ALE), Immersed Boundary Method (IBM), Large-Eddy Simulation (LES), Fluid–Structure Interaction (FSI)
Development Environment	Linux, Git
High-Performance Computing	MPI, SLURM, simulation automation
Technical Writing	LaTeX

Dr.-Ing. Khaled Boulbrachene
Hamburg, July 27, 2026