

# Bulut Tekgül, D.Sc. (Tech.)

COMPUTATIONAL SCIENTIST

Helsinki, Finland

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## Experience

### Wärtsilä Finland

Helsinki, Finland

COMBUSTION & CFD EXPERT

August 2022 - Present

- Development of a full-fledged numerical engine simulation framework from geometry to post-processed final data.
- Multi-objective parameter optimization of engine simulation parameters using Machine Learning.
- Generating, managing, and postprocessing large simulation-based datasets.

### Argonne National Laboratory

Illinois, USA

POSTDOCTORAL RESEARCHER

Jun 2021 - Jun 2022

- Design optimization of ethanol-fueled compression ignition engines using Machine Learning and Bayesian Optimization
- Numerical analysis of active and passive pre-chamber combustion engines
- Investigation of gaseous hydrogen direct-injection mixing characteristics

### Aalto University

Espoo, Finland

DOCTORAL RESEARCHER

Feb 2017 - May 2021

- Leading the development process of DLBFoam, an open-source C++ based CFD solver for reactive flows
- Efficient and accurate scientific computing and engineering software development
- Investigation of the ignition characteristics of dual-fuel combustion systems
- Completed master thesis as a visiting student and part time teaching assistant

### Roketsan Missiles

Ankara, Turkey

MECHANICAL DESIGN ENGINEER

Nov. 2015 - Feb. 2017

- CAD design of a wide range of mechanical parts used in several projects
- Aerodynamic and structural analysis using FEM and CFD
- Creating technical drawings and assembly instructions for mechanical systems
- Quality control of mechanical parts produced by 3rd party suppliers

## Education

### Aalto University

Espoo, Finland

DOCTOR OF SCIENCE AND TECHNOLOGY IN MECHANICAL ENGINEERING (CGPA: 3.86/5.00)

Aug 2017 - May 2021

- **CFD code and model development**
- **Numerical combustion**
- **Large-eddy simulation**
- **Combustion chemistry**
- **HPC applications and data analysis**

Key courses:

- Machine Learning with Python
- Programming Parallel Computers
- Numerical Matrix Computations
- Computational Fluid Dynamics

### Middle East Technical University

Ankara, Turkey

MASTER OF SCIENCE IN MECHANICAL ENGINEERING (CGPA: 3.10/4.00)

Sep 2015 - Nov 2017

- **Master thesis titled "On the applicability of progress variable approach for large eddy simulation of premixed flames"**

Key courses:

- Advanced CFD
- Advanced Fluid Mechanics
- Boundary Layer Theory
- CFD for Incompressible Flows
- CFD Using Finite Volume Method

## Research Efforts

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### Publications

#### 2023

- **B. Tekgül**, I. Liu, M. Vittal, R. Schanz, J. Blumreiter, B. Johnson, G. Magnotti, Design Optimization of an Ethanol Heavy-Duty Engine Using Design of Experiments and Bayesian Optimization, Proceedings of the ASME ICEF 22, 2023.
- S. Karimkashi, M. Gadalla, J. Kannan, **B. Tekgül**, O. Kaario, and V. Vuorinen, Large-eddy simulation of diesel pilot spray ignition in lean methane-air and methanol-air mixtures at different ambient temperatures, International Journal of Engine Research, 2023.

#### 2022

- **B. Tekgül**, S. Karimkashi, O. Kaario, H. Kahila, E. Lendormy, J. Hyvönen and V. Vuorinen, Large-eddy simulation of split injection strategies in RCCI conditions, Combustion Theory and Modelling, 2022.
- I. Morev, **B. Tekgül**, M. Gadalla, A. Shahanaghi, J. Kannan, S. Karimkashi, O. Kaario and V. Vuorinen, Fast reactive flow simulations using analytical Jacobian and dynamic load balancing in OpenFOAM, Physics of Fluids, 2022.
- S. Karimkashi, M. Gadalla, J. Kannan, **B. Tekgül**, H. Kahila, O. Kaario and V. Vuorinen, Large-eddy simulation of diesel pilot spray ignition in lean methane-air and methanol-air mixtures at different ambient temperatures, Int. J. Engine Research, 2022.

#### 2021

- **B. Tekgül**, Numerical studies for diesel spray assisted methane ignition at low temperature conditions, Doctoral Thesis, 2021.
- **B. Tekgül**, P. Peltonen, H. Kahila, O. Kaario, V. Vuorinen, DLBFoam: An open-source dynamic load balancing model for fast reacting flow simulations in OpenFOAM, Comp. Phys. Comms., 2021.
- **B. Tekgül**, H. Kahila, O. Kaario, E. Lendormy, J. Hyvönen and V. Vuorinen, Large-eddy simulation of spray assisted dual-fuel ignition under reactivity-controlled dynamic conditions, Fuel, 2021.
- M. Gadalla, J. Kannan, **B. Tekgül**, S. Karimkashi, O. Kaario, and V. Vuorinen, Large-eddy simulation of tri-fuel combustion: Diesel spray assisted ignition of methanol-hydrogen blends, Int. J. Hydrogen Energy, 2021.
- D. Izbassarov, J. Nyari, **B. Tekgül**, E. Laurila, T. Kallio, A. Santasalo-Aarnio, O. Kaario and V. Vuorinen, A numerical performance study of a fixed-bed reactor for methanol synthesis by CO<sub>2</sub> hydrogenation, Int. J. Hydrogen Energy, 2021.
- J. Kannan, M. Gadalla, **B. Tekgül**, S. Karimkashi, O. Kaario and V. Vuorinen, Large-eddy simulation of tri-fuel ignition: diesel spray-assisted ignition of lean hydrogen-methane-air mixtures, Comb. Theory and Modelling, 2021.

#### 2020

- **B. Tekgül**, H. Kahila, O. Kaario and V. Vuorinen, Large-eddy simulation of dual-fuel spray ignition at different ambient temperatures, Comb. and Flame, Vol. 215, 2020.
- J. Kannan, M. Gadalla, **B. Tekgül**, S. Karimkashi, O. Kaario and V. Vuorinen, Large eddy simulation of diesel spray-assisted dual-fuel ignition: A comparative study on two n-dodecane mechanisms at different ambient temperatures, Intl. J. Engine Research, 2020.
- M. Gadalla, J. Kannan, **B. Tekgül**, S. Karimkashi, O. Kaario and V. Vuorinen, Large-eddy simulation of ECN Spray A: sensitivity study on modeling assumptions, Energies, 2020.

#### 2019

- H. Kahila, O. Kaario, Z. Ahmad, M. Ghaderi Masouleh, **B. Tekgül**, M. Larmi and V. Vuorinen, A large-eddy simulation study on the influence of diesel pilot spray quantity on methane-air flame initiation, Comb. and Flame, 2019.

## Supervised / Advised Theses

### 2024

- **J. Alopaeus**, Modelling and validation of an industrial optical spray combustion chamber using OpenFOAM, Aalto University, 2024.
- **D. Virokannas**, Bayesian optimization of in-situ adaptive tabulation for marine engine CFD simulations, Aalto University, 2024.

### 2023

- **B. Shrestha**, Simulation and validation of an internal combustion engine under motored condition using OpenFOAM, Aalto University, 2023.

## Workshops & Conferences

- 19th International Conference on Numerical Combustion , Kyoto, Japan, 2024 - Oral presentation on AATE: Advanced Analysis Tool for Engines, and Bayesian optimization of in-situ adaptive tabulation for marine diesel engine CFD simulations.
- 10th European Combustion Meeting, Napoli, 2021 - *A load balanced chemistry model with analytical Jacobian for faster reactive simulations in OpenFOAM* (Manuscript and presentation).
- 16th OpenFOAM Workshop, Dublin, 2021 - *A dynamic load balancing model with analytical Jacobian for fast combustion simulations in OpenFOAM* (Extended abstract and presentation).
- Nordic Flame Days, Turku-Finland, 2019 - *Combustion characteristics of diesel sprays under RCCI conditions*, (Extended abstract and oral presentation).
- 17th International Conference on Numerical Combustion , Aachen, Germany, 2019 - Oral presentation on LES analysis of ambient temperature effect on diesel spray ignition in methane-air mixtures
- Finnish Flame Days, Espoo-Finland, 2018 - Oral presentation on influence of temperature on diesel spray ignition in methane-air mixtures
- Finnish OpenFOAM User Day, Espoo-Finland, 2018 - Oral presentation on premixed combustion analysis using XiFoam.
- Princeton-Combustion Institute Summer School, Princeton-USA, 2018 - Poster presentation on LES of dual-fuel spray combustion

## Teaching

- AAE-E3030 - Numerical Modeling of Multiphase Flows (Lecturer and course assistant)
- EEN-E2001 - Computational Fluid Dynamics (Course assistant)
- EEN-E1020 - Heat Transfer (Course assistant)

## Skills

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<b>Programming Language</b>	Python, C++, Fortran, MATLAB
<b>Software</b>	OpenFOAM, GridPro, PyTorch, GPy, GPyOpt, CONVERGE, CAESSES, Cantera, Chem1D, Ember, CATIA, SolidWorks, SpaceClaim, SimLab
<b>Language</b>	English (Full professional proficiency), Turkish (Native)

## Honors & Grants

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### Grants

- Merenkulun säätiö, Research grant award, 2019.

### Honors

- METU High Honor List (June 2015)
- METU High Honor List (January 2015)