Omid Bidar

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RESEARCH INTERESTS

Computational fluid dynamics • Data-driven turbulence modelling • Machine learning • Aerodynamics • Design optimisation

EDUCATION

UNIVERSITY OF SHEFFIELD, UK

2020 - 2024 **Ph.D. in Data-driven Turbulence Modelling**
Thesis: Data-driven Augmentation of Turbulence Models for Complex Fluid Flows [.pdf]

2016 - 2020 **Master of Engineering (MEng) in Aerospace Engineering** - **First-Class Honours**
Thesis: Towards statistical inference to improve turbulence RANS closures for multi-element aerofoils [.pdf]

UNIVERSITY OF MICHIGAN, ANN ARBOR, USA

2018 - 2019 **Aerospace Engineering, Global Engineering Education Exchange programme**

EXPERIENCE

Research Associate, School of Mechanical, Aerospace and Civil Engineering, University of Sheffield
October 2024 - present
Developing higher-fidelity computational models of boiling heat transfer with application to nuclear reactors.

Research Associate, Department of Automatic Control and Systems Engineering, University of Sheffield
June - October 2024
Developing vision-based methods for pipe inspection using artificial intelligence algorithms on the EPSRC grant Pipebots.

Graduate Teaching Assistant (GTA), University of Sheffield
September 2021 - December 2023
Working at the Diamond practical laboratories for the Faculty of Engineering undergraduate students where tasks including facilitating lab leaders in setting up experimental rigs; demonstrating and explaining engineering experiments to students; answering student queries; marking laboratory work and reports; and aiding in general lab administration (attendance, health and safety, etc.).
GTA roles at: Fluids Lab; Thermodynamics Lab; Electronics and Control Lab; and Aerospace Simulation and Propulsion Lab at the Diamond; and coursework marking for AER324 Aircraft Dynamics and Control.

Graduate Mentor, Sheffield Undergraduate Research Experience
June - July 2022
Supervised a second year undergraduate student to perform CFD analysis of separated flow over a multi-element high-lift aerofoil at high angles-of-attack, and the uncertainty quantification due to turbulence closure modelling.

Undergraduate Researcher, Industrial Training Programme, UoS
September - December 2019
Worked in a group of nine to investigate the use and optimisation of ducted fans for unmanned aerial systems and provide recommendations to UK Defence Science and Technology Laboratory (Dstl) mentors; individual contributions include: literature survey of optimisation frameworks, and implementation of a preliminary optimisation framework.

Undergraduate Researcher, Low Carbon Combustion Centre, UoS
June - July 2019
Working with a project co-investigator to perform numerical analysis of wall shear stresses on an impinging jet with respect to Reynold's numbers and plate temperatures for application in aviation gas turbine engines and industrial heat exchangers.

CFD Courseware Developer, Department of Multidisciplinary Engineering Education, UoS
June 2018
Designed and wrote introductory tutorials for second year students to perform CFD simulations on Ansys Fluent; produced materials cover pre-processing, execution and post-processing for scenarios involving laminar, turbulent and compressible flows; scripted short videos explaining key ideas, and introduced 'stretch target' activities.

PUBLICATIONS

JOURNAL PAPERS

1. Omid Bidar, Sean Anderson, and Ning Qin. *Sensor placement for data assimilation of turbulence models using eigenspace perturbations*. Physics of Fluids, 2024. [DOI | .pdf]

CONFERENCE PROCEEDINGS

1. Omid Bidar, Sean Anderson, and Ning Qin. *A Hybrid RANS-LES Dataset for Data-driven Turbulent Mean Flow Reconstruction*. Cambridge Unsteady Flow Symposium, March, 2024. [.pdf]
2. Omid Bidar, Ping He, Sean Anderson, and Ning Qin. *Aerodynamic Shape Optimisation Using a Machine Learning-Augmented Turbulence Model*. AIAA 2024 SciTech Forum, Orlando, USA, January, 2024. [DOI | .pdf]
3. Omid Bidar, Sean Anderson, and Ning Qin. *A Priori Sensor Placement Strategy for Turbulent Mean Flow Reconstruction Using Parametric Model Perturbations*. AIAA 2024 SciTech Forum, Orlando, USA, January, 2024. [DOI | .pdf]
4. Omid Bidar, Ping He, Sean Anderson, and Ning Qin. *Turbulent Mean Flow Reconstruction Based on Sparse Multi-sensor Data and Adjoint-based Field Inversion*. AIAA Paper 2022-3900, 2022. [DOI | .pdf]
5. Omid Bidar, Ping He, Sean Anderson, and Ning Qin. *An Open-Source Adjoint-based Field Inversion Tool for Data-driven RANS modelling*. AIAA Paper 2022-4125, 2022. [DOI | .pdf]

TALKS AND SEMINARS

1. *Data-driven turbulence model augmentation using DAFoam: sparse sensor placement, and aerodynamic shape optimisation*, online DAFoam Workshop organised by Iowa State University, July 2024. [.pdf]
2. *Machine Learning Enhancement of Turbulence Models for Aerodynamic Shape Optimisation*, UK Fluids Conference, Glasgow, Oct 2023.
3. *Parametric vs. Functional Model Uncertainty Quantification for Guiding Sensor Placement in RANS-based Data Assimilation*, Thermofluids seminar series, University of Sheffield, March 2023.
4. *Sensor Placement for RANS-based Data Assimilation Using Eigenspace Perturbations*, Data Driven Methods in Fluid Mechanics Workshop, Leeds Institute for Fluids Mechanics, March 2023. (*Winner of one out of three best presentations prize*). [.pdf]
5. *What is turbulence and how do we study it?* Tapton Seminar Series, Sheffield, January 2023. [.pptx]
6. *Relative Importance of Physical Quantities for Data-driven RANS-based Turbulence Modelling*, UK Fluids Conference 2022, University of Sheffield, Sepetember 2022. [.pdf]
7. *Turbulent flow reconstruction with sparse data*, Department of Automatic Control and System Engineering (ACSE) Research Symposium, University of Sheffield, March 2022. [.pptx]

SCHOLARSHIPS AND GRANTS

UK Engineering and Physical Sciences Research Council Doctoral Training Programme Scholarship, Department of Automatic Control and Systems Engineering, UoS, 2020-2024
Sheffield Undergraduate Research Experience Scholarship, Graduate Mentor, £1.2k, 2022
Sheffield Undergraduate Research Experience Scholarship, Undergraduate Researcher, £1.2k, 2019
Alumni Year Abroad Scholarship, University of Sheffield, £3k, 2018
Work Experience Bursary, University of Sheffield, £1.4k, 2017

SELECTED TECHNICAL REPORTS

1. *Physics-consistent Data-driven Augmentation of Turbulence Models for Complex Aerodynamic Flows*, PhD confirmation review report, September, 2021. [.pdf]
2. *Aerodynamics and control aspects of formation flight for induced drag savings*, May 2019 [.pdf]
3. *Modelling potential flow over a symmetrical body using the finite element method*, April 2019 [.pdf]
4. *Simulating flat plate heat transfer using a finite difference method*, March 2019 [.pdf]
5. *Modelling and simulation of a tumbling CubeSat*, February 2019 [.pdf]
6. *Perturbed motion: modelling, implementation and analysis for Earth-orbiting spacecraft*, December 2018 [.pdf]

SKILLS

Programming languages: MATLAB, C++, Python, Bash
CFD packages and tools: OpenFOAM, SU2, Ansys Fluent, ICEM, Pointwise
Machine learning: TensorFlow
Software: Jointly developing field inversion and machine learning capability in open-source code DAFoam (GitHub repository) with Dr Ping He.

EXTRACURRICULARS

GLOBAL VOICES | Contributing Author
May 2012 - Present | Online | Profile
Citizen media reporting and advocacy website

NIGHTLINE | Listener
October 2017 - June 2019 | Sheffield
Student-run listening and support service

OFF THE SHELF | Volunteer
October 2017 | Sheffield
Annual literary festival

CITY OF SANCTUARY | Volunteer
February - June 2016 | Sheffield
Support organisation for asylum seekers

COMMUNITY MAGAZINE | Founder
July 2013 - August 2015 | Online
Website covering news, literature, and events

PARLIAMENTARY GROUP | Campaigner
January 2013 - August 2015 | West Minister
Advocating for human rights in Afghanistan

LOCAL COMMUNITY | Language Tutor
September 2012 - August 2015 | Birmingham
Teaching Farsi as a second language

BIRMINGHAM METROPOLITAN COLLEGE |
Student Representative
September 2013 - June 2015

Miscellaneous links: Google Scholar • ResearchGate • Goodreads profile • Blog: voices 'twixt the ears