Andrew Mole

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Education

University of Manchester
Ph.D. in Aerodynamics 2018–2022

Durham University
MEng in Engineering (1:1) 2014–2018

Research Experience

Postdoctoral Research Associate with Prof. Sylvain Laizet 2023–2025
Imperial College London

- Physics Aware Machine Learning for Wind Farm Optimisation
- UKRI AI for Net Zero Project
- Development of a multi-fidelity Bayesian optimisation implemented using GPyTorch.
- Implementation of reinforcement learning approaches using TorchRL.
- Application to wind farm simulations using high order finite difference code XCompact3D.

Postdoctoral Research Assistant with Dr. Alex Skillen 2022–2023
University of Manchester

- Multi-fidelity Modelling of a Natural Convection Loop
- Rolls Royce funded project
- Developing a high-performance MPI-MPMD coupling between CFD and Systems codes.
- Development of multi-fidelity surrogate modelling to mixed-dimensional data.

PhD+ Research Assistant with Prof. Alistair Revell and Dr. Alex Skillen 2021–2022
University of Manchester

- Data Methods for Aerodynamics
- BAE Data Science Accelerator project
- Multi-fidelity aerodynamic surrogate model development.
- Developed a multi-fidelity regression framework implemented with scikit-learn in Python.
- Tested with Gaussian Process Regression and with Multi-layer Perceptrons.
- Version control managed with Git.

PhD Student with Prof. Alistair Revell and Dr. Alex Skillen 2018–2022
University of Manchester

- Advanced Hybrid RANS-LES for Motorsport Applications
- McLaren/BEACON studentship
- Coupling multiple fidelities of CFD (RANS/LES) with a nested embedded approach.
- Developed a number of OpenFOAM libraries in C++ to facilitate coupling.
- Implemented coupling framework using preCICE library with MPI for use on HPC.
- Version control managed with Git.

MEng Student with Dr. Sergii Veremieiev 2017–2018
Durham University

- Fluid Mechanics of Liquid Drops Spreading on Solid Surfaces
- Using the lubrication approximation of the Navier-Stokes equations.
- Implemented on an in house C++ code.

Summer Research Placement with Dr. Xuerui Mao 2016
Durham University

- Flow Induced Deformation of Deep Water Risers
- Investigated vortex induced vibration with filaments attached to a cylinder.
- Used the spectral element DNS code Semtex and the immersed boundary method for FSI.

Teaching Experience

Guest Lecturer 2023
The University of Manchester

- Delivered an invited lecture on *Multi-fidelity CFD for Formula One Aerodynamics* for fourth year and masters **Advanced CFD** students.

Graduate Teaching Assistant 2018–2021
The University of Manchester

- Presented, developed, and marked third year undergraduate **Aircraft Aerodynamics** lab.
- Assisted in delivery of first year undergraduate **Fluid Mechanics** lectures, labs and tutorials, managed online discussion forum and marked exam scripts.
- Assisted in delivery of fourth year and masters **Advanced CFD** lab.
- Assisted in delivery of undergraduate **Introduction to MATLAB** lab.

International Student Mentor 2018–2019
The University of Manchester

- Mentored visiting research students from the China Academy of Aerospace Aerodynamics.

Industry Experience

McLaren Racing Ltd. Jul –Oct 2021
CFD Methodology PhD Internship

- Implementing Embedded LES into Design Process Workflow
- Worked with CFD methodology and HPC teams to implement libraries with spack and git.
- Automating embedded LES set-up using python and bash scripting.

Culham Centre for Fusion Energy Aug 2013
Work Experience

- Engineering, Project Planning, and Remote Handling & Robotics departments.

Mercedes AMG Formula One Team Jul 2012
Work Experience

- Research & Development and Inspection departments.

Skills

- **Languages:** C, C++, Python, Fortran, Shell scripting
- **Technologies:** Linux, MPI, Git, Spack, Slurm, SGE

Awards

- Presentation Prize at UK Turbulence Consortium Meeting 2024
- Finalist of the ERCOFTAC Osborne Reynolds Day 2023
- Presentation Prize at UK Turbulence Consortium Meeting 2023
- Presentation Prize at the MACE PGR Conference 2020
- Winner of the ARUP Engineering Design Prize 2017

Academic Service

- Reviewer for *Flow, Turbulence and Combustion* Journal
- Reviewer for *AIAA Journal*
- Reviewer for *Computers and Fluids* Journal

Presentations

- **LES/Wake Model Multi-Fidelity Bayesian Optimisation for Wind Farms** Mar 2024
  UK Turbulence Consortium Meeting
- **Multi-Fidelity Bayesian Optimisation for the Control of Wind Turbines** Mar 2024
  ERCOFTAC Machine Learning for Fluid Dynamics Workshop
- **XGBoost-augmented RANS Closure Modelling of Complex 3D Flows** Mar 2023
  UK Fluids Network Workshop in Data-driven Methods, Machine Learning and Optimization in Fluid Mechanics
- **Multi-Fidelity Surrogate Modelling of Wall Mounted Cubes** Mar 2023
  UK Turbulence Consortium Meeting
- **Multi-fidelity Methods for Aerodynamic Applications** May 2022
  UoM Modelling and Simulation Center Seminar Series
- **Multi-fidelity Surrogate Modelling for Aerodynamic Applications** Apr 2022
  BAE Systems Physics Informed Machine Learning Seminar
- **Addressing the Challenges of Confined Embedded LES** Sep 2021
  Engineering, Turbulence, Modelling and Measurements Symposium
- **Recent Developments in Embedded Large Eddy Simulation** Jun 2021
  UK Turbulence Consortium Fundamentals Series
- **Embedded LES of Streamwise Vortices Within a Turbulent Boundary Layer** Jun 2020
  MACE Postgraduate Conference
- **Embedded LES of Turbulent Boundary Layers** Sep 2019
  UK Fluids Network Special Interest Group Meeting
- **Embedded Large Eddy Simulation of a Spatially Developing Turbulent Boundary Layer** Sep 2019
  European Turbulence Conference

Publications

[1] **A. Mole**, A. Skillen, and A. Revell, "Multi-Fidelity Surrogate Modelling of Wall Mounted Cubes," *Flow, Turbulence and Combustion*, 2022.

[2] **A. Mole**, A. Skillen, and A. Revell, "The Interaction of Longitudinal Vortex Pairs with a Turbulent Boundary Layer," *Journal of Fluid Mechanics*, 2022.

[3] **A. Mole**, A. Skillen, and A. Revell, "Addressing Challenges of Confined Embedded LES on Tandem Wall Mounted Cubes," in *13th International Engineering, Turbulence, Modelling and Measurements Symposium*, 2021, pp. 1234–1235.

[4] A. Revell, I. Afgan, A. E. A. Ali, M. C. Santasmasas, T. Craft, A. de Rosis, J. Holgate, D. Laurence, B. E. O. Iyamabo, **A. Mole**, B. Owen, M. Savoie, A. Skillen, J. Wang, and X. Zhang, "Coupled Hybrid RANS-LES Research at The University of Manchester," *ERCOFTAC Bulletin*, Progress in RANS-based Scale-Resolving Flow Simulation Methods, vol. 120, p. 67, Feb. 2020.