

# Dylan Rubini

## Multiphysics & ML Engineer

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### About Me

*"Multiphysics Engineer specialising in AI-accelerated computational modelling. Passionate about developing advanced numerical solutions to solve high-impact, complex, and multidisciplinary engineering challenges in the energy transition."*

### Professional Positions

Oct. 24–Now **Postdoc in Computational Multiphysics & ML**, *University of Oxford*.

- *Projects:*

1. Leading the design and tool development for a new turbomachine with integrated with 3D printed catalytically coated structures.
2. *Collaboration with FLAIR lab:* Developing AI systems using multi-agent large language models (LLMs) to automate engineering simulation & design.
3. *Collaboration with Carbon Xtract:* Multiphysics modelling of multiscale transport within nanomembrane CO<sub>2</sub> capture systems.

### Education and Research

2020–2024 **PhD in Engineering Science (Scholarship)**, *University of Oxford - Thermofluids*.

- *Big Picture:* Contributed to the aerothermal design, computational modelling, and tool development for a new class of supersonic turbomachines to decarbonise over 40 high-temperature industrial processes.
- *Part (I):*
  1. Developed multi-fidelity machine-learning-assisted platform ChemZIP to accelerate multiphysics reacting flow modelling by several orders of magnitude.
  2. Developed novel *chemistry-guided* design optimisers for turbomachinery.
- *Part (II):*
  1. Investigated the uniquely complex interplay between aerothermodynamics, chemistry & heat transfer using high- and low-fidelity simulations.
  2. Developed U-TBLOCK – a fully-featured, multi-zone, unstructured computational fluid dynamics solver for GPUs and CPUs at scale using a DSL.

2016–2020 **MEng in Engineering Science, 1<sup>st</sup> Class (>80%)**, *University of Oxford*.

- *Achievements:* **Top 4<sup>th</sup>** year thesis in cohort (**93%**) and scored **>80%** overall.

- *Relevant Electives:* Aerothermal Engineering I+II, Machine Learning I+II, Software Engineering, Electrochemistry, Hydraulics, Sustainable Energy.

## Awards

- 2023–2024 **2x Best Paper Awards**, *Mechanical (ASME) & Propulsion (GPPS)*.
- 2024 **IAA Doctoral Impact Prize**, *EPSRC – UK Research and Innovation*.
- 2024–Now **Drapers Research Fellowship**, *St Anne's College*.
- 2024 **Special Commendation for PhD Thesis**, *Oxford Engineering Dept.*
- 2023–2024 **20k HPC Computing Grant**, *UKRI ARCHER2 access*.
- 2020 **IMechE Project Award**, *Institution of Mechanical Engineers*.

## Industry Experience

- Autumn 2024 **Mitsubishi Heavy Industries**, *Japan*, Placement.
  - Predicting high-temperature corrosion rates in ammonia-fired boilers through coupled combustion, surface chemistry, and materials modelling.
- 2019–2024 **Coolbrook Oy**, *Finland*, Collaborator.
  - Collaborated on designing, modelling and developing tools for a new class of high-speed turbomachines for gas heating.

## Technical Skills

- Languages 1 **Expert:** Python, Fortran, Matlab, MPI programming, Domain Specific Languages (DSL, e.g., OP2), Bash scripting, Git versioning,  $\text{\LaTeX}$
- Languages 2 **Familiar:** C/C++, Cuda, OpenMP programming, Docker
- ML libraries TENSORFLOW, PYMOO (optimisation), agentic LLMs (e.g., LANGCHAIN)

### Software

- Fluids ANSYS (multiphysics), BOXER (meshing), ICEM (meshing), TBLOCK (CFD), OPENLB (CFD), SolidWorks (CAD), PARAVIEW (post-processing)
- Chemistry RMG-PY (generating micro-kinetic models), CANTERA (solving kinetics)

## Publications and Talks

- 2020–2025 **Publications**, 7x journal publications (<https://dylanrubini.github.io/>).
- 2020–2025 **Talks**, 10x talks at global conferences, universities & industrial partners.
- 2025–Now **Societies**, Founded MathWorks–supported Oxford Numerical Modelling Society.

## Supervision and Teaching

### PhD Supervision

- 2024–Present Exotic compact, 3D–printed heat topology optimisation.
- 2024–Present Accelerating multiscale numerical modelling.

## Undergraduate Teaching

Winter 2025 2<sup>nd</sup> year partial differential equations.

Winter 2025 2<sup>nd</sup> year heat transfer lab.

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## Certified Courses

OPENLB Developed custom lattice Boltzmann PDE solvers

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## Referees

Available upon request