UNIVERSITY OF LEEDS

CANDIDATE BRIEF

Summer Research Internship – Future Fluid Dynamics CDT

Faculty of Engineering and Physical Sciences

Salary: Grade 4 (£26,707 - £28,778 p.a.)

Reporting to: Dr Shufan Yang, School of School of Mechanical Engineering

Reference: EPSMA1140

Closing date: Monday 01 June 2026

Fixed term (between 6-12 weeks, available from 01 June 2026 - to complete specific time limited work)

Location: Leeds Main Campus

We are open to discussing flexible working arrangements

Summer Research Internship - Future Fluid Dynamics CDT, Faculty of Engineering and Physical Sciences.

Are you interested in gaining first-hand experience of the research environment in fluid dynamics at the University of Leeds? Would you like to explore this opportunity to help you make an informed decision about progressing to postgraduate research? Would you like to develop knowledge, skills and experience to strengthen your application for research degree opportunities?

The EPSRC Centre for Doctoral Training (CDT) in Future Fluid Dynamics, hosts an annual internship programme throughout summer. This opportunity is designed to enhance access to postgraduate research for individuals from underrepresented groups, supporting a more diverse and inclusive research community.
The programme allows prospective postgraduate researchers to gain first-hand experience of the research environment in fluid dynamics at the University of Leeds.

This experience will assist them to help informed decisions around progression to PGR and to develop relevant knowledge, skills and experience that can strengthen their applications to research degree opportunities. The centre provides advanced training and research opportunities in the field of fluid dynamics, with the aim of equipping future academics and industry practitioners with the interdisciplinary skills required to tackle complex fluid-related challenges across a range of industrial and scientific sectors. Research areas are Engineering and Physical Sciences, Environment, Biological Sciences, or Medicine and Health.

Widening participation

Applications are open to those who have *not* undertaken a research internship previously, and meet one or more of the following criteria:

- The first in their family to go to university;
- From Black, Asian or other minoritised ethnic groups;
- Neurodivergent (e.g. ASD, ADHD) and/or Disability (e.g. physical impairments, mental health condition, learning difficulties, chronic illness);
- Are female;
- Have caring responsibilities;
- Have been outside of education for 5 or more years;
- Studying/studied at a university that is not a member of the Russell Group.

About the project

Title: Building Reliable Meshes for Vascular Flow Simulation using a Machine Learning Method

Accurate computational fluid dynamics (CFD) simulations of blood flow depend critically on volumetric mesh quality, particularly in complex vascular geometries. However, solver-relevant mesh quality thresholds remain poorly defined, and existing automated meshing tools are rarely evaluated using data-driven or predictive approaches. This three-month project aims to establish validated mesh quality thresholds for blood flow CFD, benchmark widely used open-source meshing tools, and explore machine learning methods to predict and assess mesh suitability for CFD simulations.

In the first month, representative vascular geometries—including straight vessels, curved vessels, and bifurcations—will be prepared from STL surfaces using automated cleaning and repair workflows. Volumetric meshes will then be generated using TetGen (Delaunay tetrahedralization), Gmsh (frontal–Delaunay hybrid meshing), and snappyHexMesh (hex-dominant cut-cell meshing), with consistent target element sizes and boundary layer resolution to ensure fair comparison. Mesh metadata and geometric features will be systematically collected to form a structured dataset.

During the second month, volumetric mesh quality will be evaluated using both traditional and data-driven approaches. Standard geometry-based and CFD-specific metrics—including aspect ratio, skewness, scaled Jacobian, dihedral angles, cell size growth rate, non-orthogonality, and near-wall resolution—will be computed. In parallel, a supervised machine learning model (e.g., regression or classification) will be trained to predict mesh quality and expected solver performance based on these metrics. This model will be used to identify combinations of quality indicators that best correlate with stable and accurate blood flow simulations, enabling the derivation of data-informed quality thresholds.

In the final month, steady and pulsatile blood flow simulations will be performed on selected meshes to evaluate solver convergence, mass conservation, pressure drop, velocity fields, and wall shear stress distributions. Simulation outcomes will be used to validate both the recommended quality thresholds and the machine learning predictions. The computational efficiency, robustness, and level of automation of each

meshing tool will be compared, highlighting their suitability for biomedical CFD workflows.

Overall, this project combines classical CFD analysis with machine learning-based quality assessment, delivering practical guidelines and predictive tools to support reliable, automated blood flow simulations.

Overview of the role

To undertake independent research project supervised by an academic at the University of Leeds. This project will take place over 210 hours worked over a period of 6 weeks to 3 months during summer.

Main duties and responsibilities

- Generate volumetric meshes of representative vascular geometries using open-source meshing tools;
- Investigate and compute established measures of mesh quality for these meshes;
- Develop a supervised machine learning model trained to predict mesh quality and expected solver performance;
- Perform steady and pulsatile blood flow simulations using different meshes;
- Write a report on findings of this study.

These duties provide a framework for the role and should not be regarded as a definitive list. Other reasonable duties may be required consistent with the grade of the post.

Developmental benefits

This summer project will provide the intern with hands-on experience in multidisciplinary research at the intersection of computational engineering, biomedical modelling and optimisation. This position will allow the intern to develop their professional skills including communication, time management and problem-solving skills for novel research.

Qualifications and skills

Qualifications

- Open to graduates or current second- or third-year undergraduates eligible for the Home (UK) fee-rate at postgraduate research (PGR).

Essential

- Curiosity and willingness to learn skills and techniques;
- Critical thinking;
- Good verbal and written communication skills;
- Ability to work both independently and as part of a team;
- Project specific:
    - Ability to analyze numerical results;
    - Confidence in interpreting plots, tables, and solver outputs;
    - Curiosity and persistence when dealing with complex or imperfect data.

Desirable

- Project specific:
    - Prior exposure to biomedical or biofluid applications.

How to apply

You can apply for this role online; more guidance can be found on our How to Apply information page. Applications should be submitted by **23:59** (UK time) on the advertised closing date.

Please upload a supporting statement (Word or PDF) with the following details:

- An **introduction** to yourself and a **brief overview** of why you are applying for your chosen project and the internship;
- An outline demonstrating how you meet all **essential** and **desirable criteria** in the job description. Please address each criterion separately, clearly referencing the specific criterion;
- A description of which **widening participation criteria** mentioned in the job description you satisfy.


Contact information

To explore the post further or for any queries you may have, please contact:

Dr Shufan Yang, Associate Professor in Optimisation & Computational Intelligence
Email: S.F.Yang@leeds.ac.uk

OR

Patricia Grant, Centre Manager
Email: P.Grant@leeds.ac.uk

Additional information

Faculty and School Information
Further information is available on the research and teaching activities of the Faculty of Engineering & Physical Sciences, and the School of Mathematics.

Working at Leeds
We are a campus-based community and regular interaction with campus is an expectation of all roles in line with academic and service needs and the requirements of the role. We are also open to discussing flexible working arrangements. To find out more about the benefits of working at the University and what it is like to live and work in the Leeds area visit our Working at Leeds information page.

A diverse workforce
As an international research-intensive university, we welcome students and staff from all walks of life and from across the world. We foster an inclusive environment where all can flourish and prosper, and we are proud of our strong commitment to student education. Within the Faculty of Engineering and Physical Sciences we are dedicated to diversifying our community and we welcome the unique contributions that individuals can bring, and particularly encourage applications from, but not limited to Black, Asian and ethnically diverse people; people who identify as LGBT+; and people with disabilities. Candidates will always be selected based on merit and ability.

We have identified that women are currently underrepresented in this role and particularly welcome applications. Candidates will always be selected based on merit and ability.

The Faculty of Engineering and Physical Sciences are proud to have been awarded the Athena SWAN Silver Award from the Equality Challenge Unit, the national body that promotes equality in the higher education sector. Our equality and inclusion webpage provides more information.

Information for disabled candidates
Information for disabled candidates, impairments or health conditions, including requesting alternative formats, can be found under the 'Accessibility' heading on our How to Apply information page or by getting in touch by emailing HR via hr@leeds.ac.uk.

Criminal Record Information
Rehabilitation of Offenders Act 1974
A criminal record check is not required for this position. However, all applicants will be required to declare if they have any 'unspent' criminal offences, including those pending.

Any offer of appointment will be in accordance with our Criminal Records policy. You can find out more about required checks and declarations in our Criminal Records information page.