UNIVERSITY OF LEICESTER

EPSRC-MAT1-GAR

Transition in rotating boundary-layer flows

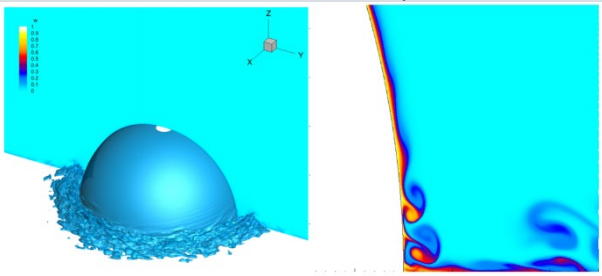
Highlights

Contribution to the next generation of disruptive technologies for the reduction of aerodynamic drag towards achieving environmental pollution targets

Mathematics and DNS & LES simulations

International collaboration with Australian group

Level	PhD
First Supervisor	Prof Stephen Garrett
Second Supervisor	Dr Andrew Mc Mullan
Application Closing Date	21st January 2019
Subject Areas	Applied Mathematics Aeronautical Engineering Fluid Dynamics



DNS images, due to Calabretto, that show the two major aspects of the rotating-sphere flow: the onset of spiral vortices at large latitudes from the pole and the boundary-layer eruption at the equator. The project aims to further clarify the physics of these two aspects and their mutual interaction

Overview

This project is across the distinct disciplines of mathematical and computational fluid mechanics and aims to provide insight into open problems in fundamental fluid physics. The successful candidate will join a newly-established international team based in the UK and Australia and will involve an extended research visit to Macquarie University, Sydney, Australia.

Using, as a model flow, the surprisingly complex global flow field that results when a sphere spins up from rest, the principal goals of this project are twofold:

- To provide a deep and fundamental insight into the behaviour of fluid flows that exhibit transient behaviour, thereby providing answers to several outstanding questions in the fluid mechanics of unsteady fluid flows;
- To use this knowledge to explore strategies for controlling unsteady separation and transition in this broad class of flows.

The project will, by its grand scope, produce solutions with far reaching applications to a wide range of unsteady fluid flow problems, such as those that occur, for example, in controlling the onset of drag over aircraft, the dynamic stall of aircraft, or within internal arterial flows. With regards aerospace, it will contribute to the introduction of the next generation of innovative and disruptive technologies via its interaction with research in how to control flow to reduce aerodynamic drag towards achieving environmental pollution targets. Furthermore, this has a subsequent impact on how we manage our natural resources efficiently and sustainably.

Methodology, Critical Skills and Training and Development

- CFD mesh & sub-grid development and validation for use in direct numerical simulations [team effort joint with McMullan and Calabretto, programming]
- Simulation and analysis of erupting region to clarify precise physics at play [team effort joint with Calabretto, programming, use of ALICE]

- Determination of the asymptotic structure of the erupting region [team effort joint with Garrett, mathematics]
- Extension of Garrett's global stability analysis that incorporates the above structure [team effort joint with Calabretto and Garrett, programming and mathematics]
- Extension of prior mesh to permit DNS of global flow field [team effort joint with McMullan and Calabretto]
- Comparison of mathematics to simulations [team effort involving all]
- Communication of results [scientific communication skills, written, oral, team effort involving all]

Additional Entry Requirements

- Degree in Applied Mathematics, Mechanical Engineering, Physics or similar
- Excellent programming skills, including MATLAB
- Willingness to travel and spend time in Sydney, Australia

Funding

This research project is one of a number of projects in the College. It is in competition for funding with one or more of these projects. Usually the project which receives the best applicant will be awarded the funding.

Home/EU Applicants

This project is eligible for a fully funded EPSRC studentship which includes :

- A full UK/EU fee waiver for 3.5 years
- An annual tax free stipend of £14,777 (2018/19)
- Research Training Support Grant (RTSG)

Studentships are available to UK/EU applicants who meet the EPSRC Residency Criteria; if you have been ordinarily resident in the UK for three years you will normally be entitled to apply for a full studentship.

If you are an EU student and do not meet the residency criteria, please contact csepgr@le.ac.uk for more information on the funding options available.

International Applicants

- Unfortunately, there is no funding for international students on this project.

Application Instructions

The online application and supporting documents are due by **Monday 21st January 2019**.

Any applications submitted after the deadline will not be accepted for the studentship scheme.

References should arrive no later than **Monday 28th January 2019**.

Applicants are advised to apply well in advance of the deadline, so that we can let you know if anything is missing from your application.

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Required Materials

1. Online application form
2. Two academic references
3. Transcripts
4. Degree certificate/s (if awarded)
5. Curriculum Vitae
6. EPSRC Studentship Form
7. English language qualification

Applications which are not complete by the deadline will not be considered for the studentship scheme. It is the responsibility of the applicant to ensure the application form and documents are received by the relevant deadlines.

All applications must be submitted online, along with the supporting documents as per the instructions on the website.

Please ensure that all email addresses, for yourself and your referees, are correct on the application form.

For more information, please visit our website at :
https://www2.le.ac.uk/colleges/scieng/research/postgraduate-opportunities/epsrc-2019/instructions