

School of Computing, Engineering, and the Built Environment Edinburgh Napier University

PHD STUDENT PROJECT

Funding and application details

Funding status: Self funded students only

Application instructions:

Detailed instructions are available at https://blogs.napier.ac.uk/sceberesearch/available-phd-student-projects/

Prospective candidates are encouraged to contact the Director of Studies (see details below) to discuss the project and their suitability for it.

Project details

Supervisory Team:

- DIRECTOR OF STUDY: Dr Chennakesava Kadapa (Email: C.Kadapa@napier.ac.uk)
- 2ND SUPERVISOR: Dr Firdaus Muhammad Sukki

Subject Group: Engineering & mathematics

Research Areas: Engineering, Mathematics

Project Title: Computational Fluid-Structure Interaction with Turbulent and Multiphase flows

Project description:

Fluid-structure interaction (FSI) problems involving turbulent and multiphase flows and flexible structures find numerous applications in Science and Engineering, e.g., aeroelasticity of aircraft wings and wind turbine blades, wave-structure interactions of offshore structures, flexible wave energy converters, floating solar farms, and flight of birds and insects.

Recent advances in multifunctional polymeric composites over the past couple of decades have led to the explosion of innovative designs for various applications,

e.g., morphing wings and flexible wave energy converters, that involve flexible structures or a combination of rigid and flexible structures interacting with turbulent and multiphase flows.

Prominent challenges in the simulation of FSI problems with flexible structures and turbulent multiphase flows are: (i) accurate capture of boundary layers, (ii) large structural deformations, (iii) coupled interaction of flexible structures with turbulent and multiphase flows, and (iv) large-scale models needed for accurate results. Towards addressing challenges in simulating these problems, this project will develop advanced simulation platforms with the capabilities to conduct computationally efficient high-fidelity coupled simulations of challenging FSI problems. This project includes collaborations with other universities at the national and international levels.

The project consists of the following major activities:

- Couple FE framework for flexible solids with Opensource CFD solvers.
- Parallelise the simulation framework.
- Validate the simulation framework.
- Disseminate research outputs in journals and at conferences.

References:

Candidate characteristics

Education:

A first-class honours degree, or a distinction at master level, or equivalent achievements in Mechanical Engineering, Civil Engineering, Aerospace Engineering, Marine Engineering, Coastal Engineering

Subject knowledge:

- Fluid Mechanics
- Solid Mechanics
- Computational Fluid Dyanmics
- Finite Element Method
- Programming

Essential attributes:

- Experience in programming for FEM, FVM or similar numerical methods.
- Competent in programming in at least one of C, C++, Fortran, Python, MATLAB or Julia.
- Basic knowledge of modelling and simulation technologies.
- Good written and oral communication skills.
- Self-motivation, with evidence of independent learning.

Desirable attributes:

- Programming in C++.
- Experience in using simulation software such as ANSYS, COMSOL, StarCCM+, OpenFOAM and SU2.