



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

PHD STUDENT PROJECT

Application instructions:

Detailed instructions are available at :

<https://www.napier.ac.uk/research-and-innovation/doctoral-college/how-to-apply>

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

Project details

Funding status: Funded PhD Project (Worldwide)

Supervisory Team:

- Director of Study: Dr Chennakesava Kadapa (Email: c.kadapa@napier.ac.uk)
- 2ND SUPERVISOR: Dr Fadi Kahwash
- 3rd Supervisor: Dr Mokarram Hossain

Subject Group: Engineering & Mathematics

Research Areas: Mechanical Engineering, Aerospace Engineering, Biomedical Engineering, Fluid Mechanics, Structural Mechanics, Solid Mechanics, Structural Engineering

Project Title: Computational Methods for Fluid-Structure Interaction problems

Project description:

Fluid-Structure Interaction (FSI) problems involving thin structures find numerous applications in Science and Engineering, e.g., heart valves, arteries, parachutes, canopies, stadium roofs, wind turbine blades, and insect wings. This PhD studentship focuses on developing advanced numerical methods for simulating the coupled fluid-structure interaction of thin flexible structures modelled using beam and shell finite elements, including multiphysics effects of electromagnetic excitations into consideration.

The PhD student will work with other PhD students and post-docs on the recently funded project, MAPFSI: Multiphysics Simulation of Magneto-Active Polymers and

their Fluid-Structure Interaction, by the UK's Engineering and Physics Sciences Research Council (EPSRC). The studentship provides with opportunities for collaborative research on cutting-edge simulation methodologies for multiphysics problems.

The major activities of the project are:

- Develop the FSI framework for flexible structures.
- Test and validate the simulation framework.
- Disseminate research outputs in journals and at conferences.
- Collaboratively work with other PhD and post-docs in the project.

Perspective applicants are encouraged to contact the supervisor, Dr Chennakesava Kadapa at c.kadapa@napier.ac.uk, before submitting their applications.

References:

[1] C. Kadapa, W. G. Dettmer, D. Perić. "A stabilised immersed framework on hierarchical b-spline grids for fluid-flexible structure interaction with solid-solid contact", *Computer Methods in Applied Mechanics and Engineering*, 335:472-489, 2018.

[2] C. Kadapa, W. G. Dettmer, D. Perić. "A fictitious domain/distributed Lagrange multiplier based fluid-structure interaction scheme with hierarchical B-Spline grids", *Computer Methods in Applied Mechanics and Engineering*, 301:1-27, 2016.

[3] C. S. Peskin. "Flow patterns around heart valves: A numerical method". *Journal of Computational Physics*. **10** (2): 252–271, 1972.

Candidate characteristics

Education:

A first degree (at least a 2.2) ideally in Mechanical/Civil/Aerospace/Ocean Engineering or Mathematics with a good fundamental knowledge of fluid mechanics, solid mechanics, finite element method, numerical methods and computer programming.

English language requirement:

IELTS score must be at least 6.5 (with not less than 6.0 in each of the four components). Other, equivalent qualifications will be accepted. [Full details of the University's policy](#) are available online.

Essential attributes:

- Experience of fundamental fluid mechanics, solid mechanics, FEM.
- Competent in MATLAB or Python or C or C++ or Julia or Fortran.
- Knowledge of numerical methods, modelling and simulation.
- Good written and oral communication
- Strong motivation, with evidence of independent research skills relevant to the project
- Good time management

Desirable attributes:

- Experience in using simulation software such as ANSYS, Abaqus, OpenFOAM, COMSOL, SU2 etc.
- Code development for the FEM.
- Programming in C or C++.

Enquiries: For informal enquiries about this PhD project, please contact Chennakesava Kadapa at c.kadapa@napier.ac.uk