



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://www.napier.ac.uk/research-and-innovation/research-degrees/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

Supervisory Team:

- DIRECTOR OF STUDY: Islam Shyha (Email: I.Shyha@napier.ac.uk)
- 2ND SUPERVISOR: Suha Jaradat and Reza Salehiyan

Subject Group: Engineering & mathematics

Research Areas: Manufacturing Engineering, Mechanical Engineering, Polymers, Civil Engineering

Project Title: Recycling Polymeric based Composites for Construction Applications

Project description:

In the UK, glass fibre-reinforced plastic (GFRP) contributes to 75,000 tons end of life waste in addition to 6,200 tons of production waste. Because 90% of the UK's FRP currently goes to landfill, the development of recycling solutions for composites is necessary. This is also due to the recent adoption of strict environmental legislation (such as the EU's End of Life Vehicles Directive which aims to reduce the automotive waste disposed of in landfill by setting targets for reuse, recycling and recovery of materials). This has also led to increased restrictions and costs of composite landfill disposal (Composite in Manufacturing, CIM December 2019, pp 59). On the other hand, the use of composite materials is

considerably rising in many industries including aerospace, automotive, sports and medical equipment. Polymeric composites, such as CFRPs and GFRPs, are typically manufactured by laying up pre-impregnated sheets and hence machining processes are necessary to achieve the required geometrical & dimensional accuracy and create features such as holes for assembly.

This project aims to critically investigate different methods of recycling/reusing composite waste (either as production waste or end-of-life waste) to develop strategies for manufacturing functionalised construction structures entirely/partially made from waste. The project is experimentally based and will include the use of equipment such as 3D printers, a CNC machining centre, and optical and electron microscopy. The project will also create an advanced computer model using ABAQUS to investigate the structural behaviour of GFRP and CFRP composite structures made from recycled materials. The models will be validated using experimental results and then will be used in a detailed parametric study. Finally, a new set of design equations based on experimental and numerical studies will be developed to determine the structural capacities of GFRP and CFRP composite structures made of recycling materials.

References:

Candidate characteristics

Education:

A second class honour degree or equivalent qualification in Manufacturing Engineering

Subject knowledge:

- Mechanical Engineering
- Materials Engineering

Essential attributes:

- Experience in fundamental of Materials Science and Manufacturing
- Competent in conducting laboratory experimental and data analysis
- Competent in CAD
- Good written and oral communication skills
- Strong motivation, with evidence of independent research skills relevant to the project
- Good time management

Desirable attributes:

- Knowledge of composites, manufacturing, design, and materials characterisation