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

PHD STUDENT PROJECT

Funding and application details

Funding status: Fully funded project (worldwide)

Application instructions:
Detailed instructions are available at https://blogs.napier.ac.uk/scebe-research/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: Islam Shyha (Email: I.Shyha@napier.ac.uk)
- 2ND SUPERVISOR: Ahmed Al-Dubai and Suha Jaradat

Subject Group: Engineering & mathematics

Research Areas: Manufacturing Engineering, Mechanical Engineering, Polymers

Project Title: Innovative Energy Harvesting Solutions for Green Buildings

Project description:

for approximately 30% of total global energy consumption and approximately 27% of energy sector emissions. The goal of this multidisciplinary project is to create new techniques for harvesting energy from footsteps and acoustic energy sources (zero-net resources such as footstep mats, flexible solar panels, and sound detection) that can be used in green buildings.

The study includes both synthesis and characterisation of piezoelectric nanofiber mats in response to different mechanical/acoustic excitations. Subsequently, such mats will be embedded with electric setups within carpets and curtains. Furthermore, such a piezo system will be aligned with commercial flexible solar

panels to coordinate the reception of harvested energy from multiple renewable resources inside the green buildings. All the outputs aim to achieve the main goal of the project of providing innovative and secured solutions for zero-net energy buildings.

This is an experimental study in which successful candidates will design parts/tools using appropriate CAD packages. The project's main focus is on optimising the fabrication of large scale nanofibrous membranes from various polymeric materials using techniques such as solution blow spinning. Characterisation techniques such as scanning electron and optical microscopy, X-ray diffraction, and FTIR will be used to support this. The manufactured and optimised membranes will then be used in a green-housing prototype in which energy will be harvested from various resources.

References:

[1] Elnabawy, E., Farag, M., Soliman, A., Mahmoud, K., Shehata, N., Nair, R., Kandas, I., Atif, R., Combrinck, M., Khaliq, J. and Shyha, I., 2021. Solution blow spinning of piezoelectric nanofiber mat for detecting mechanical and acoustic signals. Journal of Applied Polymer Science, 138(45), p.51322.

[2] Omran, N., Elnabawy, E., Le, B., Trabelsi, M., Gamal, M., Kandas, I., Hassanin, A.H., Shyha, I. and Shehata, N., 2022. Solution blow spun piezoelectric nanofibers membrane for energy harvesting applications. Reactive and Functional Polymers, 179, p.105365.

Candidate characteristics

Education:

A first-class honours degree, or a distinction at master level, or equivalent achievements in Materials Engineering

Subject knowledge:

- Manufacturing Engineering

Essential attributes:

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

Desirable attributes:

- Candidates should have a basic understanding of mechanical design and, if shortlisted, should be familiar with the fundamentals of green and zero-net energy buildings.
- Essential IT skills and basic knowledge of IT security