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

MRes 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

Supervisory Team:

- DIRECTOR OF STUDY: Prof. Hexin (Johnson) Zhang (Email: j.zhang@napier.ac.uk)
- 2ND SUPERVISOR: tbc

Subject Group: Engineering & Mathematics

Funding status: Self funded

Project Title: Develop novel engineered bio-based structural systems for long span and tall buildings

Project description:

The UK and several other EU countries are the leading countries on developing advanced sustainable construction materials such as timber and engineered wood products. Some of the most advanced research developments on Glued Laminated Timber (Glulam) in recent years has led to the construction of tall timber buildings in Europe including the Mjøsa Tower, Norway (2018), the HoHo Wien, Austria (2018) and the Sapanta-Peri Church, Romania (2013) and many more are in the planning stage.

Glued Laminated Timber (glulam) is one of the most popular materials used in this type of construction. Timber glulam material is becoming increasingly more popular due to its excellent performance, sustainability and aesthetic characteristics. However, compared to traditional building materials such as concrete and steel, the strength of timber has prevented engineers to design and construct the long span and tall building

structures. Therefore, combining glulam and other higher strength construction material presents itself as a sensible solution. Despite this argument, using timber-steel/concrete composites has gathered very few supporters due to the diminished appeal of the timber wooden appearance.

Bamboo is one of the fastest-growing plants on Earth; it is widely planted in many countries. Laminate bamboo glulam has also been widely used to manufacture furniture, flooring, worktops, etc. in Asia. Laminate bamboo has: 1) impressive tensile and compressive strength (higher than mild steel) ; 2) similar thermal expansion coefficient to timber and, 3) an attractive wooden appearance which has made it a perfect material to produce timber-bamboo composite material and to form stronger structural elements to: 1) span a long distance; 2) reduce the size and self-weight of the structure and therefore results in a more efficient, economical yet aesthetic composite structure system.

Since 2015, the research team at Edinburgh Napier University has focused on developing the Bamboo and Softwood Timber composite materials. Several prototype products have been designed and manufactured. The test results have revealed the great potentials of these Bamboo-Timber composite materials. The combination of these two economical, fast-growing natural materials can achieved the same strength as hardwood glulam beam. They are excellent sustainable, environmental-friendly and architect-favoured construction materials for building tall and long-span structures.

The potential of this novel research has been recognized by the experts in the industry. The partnership established with the Intelligent Wood System Ltd and Glenalmond Timber Company in Scotland on developing the Bamboo-Timber composite material has won the Royal Academy of Engineering Industrial Fellowship in 2019 (https://raeng.org.uk/programmes-and-prizes/programmes/meet-the-researchers/dr-hexin-johnson-zhang).

This MRes will build on previous success, working closely with the existing Industrial partners to develop this patentable composite materials further with the consideration of structural modelling, optimisation, manufacturing and commercialisation of these new products.

Candidate characteristics

Education:

A first-class honours degree, or a distinction at master level, or equivalent achievements in Game Design, Game Development, Computer Science, Human-Computer Interaction, Digital Media, or User Experience Design.

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 structure, materials and civil engineering
- Competent in literature review, report writing and statistical and/or qualitative analysis
- Knowledge of lab and numerical simulation
- Good written and oral communication skills
- Strong motivation, with evidence of independent research skills relevant to the project
- Good time management

Application checklist:

- Completed application form
- CV
- 2 academic references, using the Postgraduate Educational Reference Form (download)
- A personal research statement (This should include (a) a brief description of your relevant experience and skills, (b) an indication of
- What you would uniquely bring to the project and (c) a statement of how this project fits with your future direction.)
- Evidence of proficiency in English (if appropriate)