

UQ Summer Research Project Description

Please use this template to create a description of each research project, eligibility requirements and expected deliverables. Project details can then be uploaded to each faculty, school, institute, and centre webpage prior to the launch of the program.

Project title:	Robotic FRP fabrication with a customised non-standard geometry
Project duration, hours of engagement & delivery mode	6 weeks, 13 January to 21 February 2025. 20–36 hours per week. This project will be offered at UQ St Lucia Campus.
Description:	<p>Recent studies on topology optimisation have found that material efficiency can be significantly improved by using irregular sections to replace the conventional sections in some structural members. The optimised structures also tend to have changing cross-sections along the member span or height, such as the tree-like structure used at the Qatar National Convention Centre and the Art Nouveau Apartment by Flying Concrete in San Miguel De Allende Mexico. FRP is found to be a promising material for the irregular profiles because of its high flexibility. However, conventional manufacturing techniques have their limitations on irregular shapes.</p> <p>This project investigates a proposed fabrication method that is inspired by the novel hybrid double-skin tubular arch bridge system developed at UQ, in which prefabricated FRP tubes are used both as formworks for concrete casting and as reinforcement to construct a hybrid bridge structure.</p> <p>Based on this system of construction, our research explores the potential to use robotic technology for robotic fabrication of structural members with greater formwork flexibility, to reduce the cost of transportation and to increase the material and structural efficiency of the building structure.</p> <div data-bbox="432 1469 1366 1890" style="text-align: center;"> <p style="text-align: center;">Spatial extrusion of non-uniform FRP shell for large scale structure component</p> <p style="text-align: center;">Uniform profile Variation in Section Variation in Direction Variation in Section & Direction</p> </div>
Expected outcomes and deliverables:	Scholars may gain skills in basic industrial robot control, non-standard geometry design optimisation, robotic fabrication path planning, and prototype fabrication experience.

	<p>Expected deliverables include:</p> <ul style="list-style-type: none"> • An adaptive path planning for robotic fabrication with non-standard FRP tube geometry. • The design and fabrication of a jointing system between robotic fabricated subassemblies. • A final customized concrete-filled FRP tube prototype will be fabricated if applicable. <p>There will also be an opportunity to generate publication based on the prototype geometry design pattern and the robotic fabrication method.</p>
<p>Suitable for:</p>	<p>This project is open to senior undergraduate and master's students with a background of civil engineering or architecture. One student with a background in civil engineering and one in architecture is preferred.</p> <p>Students who have previous experience with FRP/concrete or rhino/grasshopper will be given higher priority. The students must gain access to the structure lab and industrial robotic arm by completing all relevant inductions before the research program.</p>
<p>Primary Supervisor:</p>	<p>Dr Dan Luo</p>
<p>Further info:</p>	<p>Dr Dan Luo d.luo@uq.edu.au Please contact the supervisor prior to submission.</p>