Updated 17/03/23

2023 UQ Winter Research Project Description

Project Title:	Constructing hydrogen network in Queensland
Project Duration:	4 weeks and the applicant will be required on-site for the project.
Positions Available:	2
Description:	The aim of the project is to examine QLD plans for developing renewable regions, availability of resources and infrastructure, as well as potential energy storage facilities and make suggestions for developing renewable energy and hydrogen pipe networks in Queensland. The project requires innovative thinking that does not necessarily follows established/government stereotypes and ideas. *Some variations of the topic are possible.*
Expected Outcomes and Deliverables:	The project is expected to result in an alternative strategic plan for Queensland that might be better in some respects than the existing plans. We understand and accept that the student's ideas might be controversial in some respects. A brief report is expected at the end.
Suitable for:	This project is suitable for 3rd or 4th year Mechanical, Mechanical and Aerospace, Mechatronic and Mining Engineering students. An interest in topics such as fluid dynamics, thermodynamics, renewables, energy, combustion is encouraged but not required.
Supervisor:	Alex Klimenko and Yuanshen Lu a.klimenko@uq.edu.au
Further info:	Please email Alex at a.klimenko@uq.edu.au if you are interested in applying for the project.

Project Title:	Investigation into automation of UQ's X2 Expansion Tube
Project Duration:	4 weeks and the applicant will be required on-site for the project.
Positions Available:	1
Description:	UQ's X2 Expansion Tube is an impulse wind tunnel for the study of planetary entry. It can be fired several times a day and currently it is operated manually by an experimenter and a facility operator who fill each section of the facility to the correct compositions and pressures before the facility is fired. X2 is one of the only remaining major hypersonic test facilities in the world which is still operated manually. Today most major hypersonic test facilities worldwide are operated by some kind of Programmable Logical Controller (PLC) which automatically fills and fires the facility for each experiment. This project aims to investigate doing this for the X2 expansion tube to improve the repeatability, reliability and safety of the facility. Currently, UQ's Centre for Hypersonics is investigating automation of the X2 expansion tube and its sister facility the T4 Stalker Tube. A preliminary design has been created to automate the T4 facility, assuming that automating X2 will be a similar process. This is somewhat true, but X2's automation will also have some other requirements due to X2's operation at much lower pressures and much higher speeds. The aim of this project is to work from the preliminary T4 design and provide a high-level design and costing to automate the X2 expansion tube facility.
Expected Outcomes and Deliverables:	The expected deliverable is a report detailing the requirements and cost to automate the X2 expansion tube facility. Students will learn about hypersonic impulse facility operation, facility automation, and interacting with suppliers and costing such an endeavour.
Suitable for:	This project is suitable for 3rd or 4th year Mechanical, Mechanical and Aerospace or Mechatronic Engineering students. An interest in topics such as fluid dynamics, hypersonics, and automation are encouraged but not required.
Supervisor:	Chris James c.james4@uq.edu.au
Further info:	Please email Dr Chris James (c.james4@uq.edu.au) if you are interested in applying for the project.

Project Title:	Cold driver for X3 expansion tube
Project Duration:	4 weeks
Positions Available:	1
Description:	The multi-mode X3 impulsive facility is located at the hypersonics research precinct at Eagle farm, and is owned by UQ and operated and maintained by DSTG. It currently uses a 'free piston driver' to provide the high pressure, high temperature gas needed to drive the shock waves by a compression process. Whilst this is a very effective method for the study of many high speed flows, there are some conditions where a static cold driver is preferred. This project involves the mechanical and ergonomic design of a cold driver modification to X3, which can be easily installed and removed as required with minimal interruption to the operating schedule. The project will conclude with the preparation of a report detailing and explaining the findings and recommendations of the work, and with the technical details of the proposed design.
Expected Outcomes and Deliverables:	Students will gain experience in the design of highly stressed equipment, and in the operating principles of shock and expansion tubes. They will have to interact with the operating team at the laboratory to gain some understanding of the practicalities of impulse facility operations. They will develop report writing and interaction skills through dealing with and meeting the requirements of an external research group.
Suitable for:	Students will need mechanical design skills and a knowledge of compressible gas dynamics.
Supervisor:	Richard Morgan r.morgan@uq.edu.au and Matthew Thompson
Further info:	Please send any enquiries to r.morgan@uq.edu.au

Project Title:	Navigating the Unpredictable: Quantifying Uncertainty in Relative Permeability Estimates in Rough Fractures
Project Duration:	4 weeks and applicant will be required on-site for the project
Positions Available:	1
Description:	Natural gas is important for many reasons - it helps us reduce our reliance on coal and other non-renewable sources of energy, and it's used to make fertilisers that are crucial for growing food. But producing natural gas can have negative effects on the environment, like using up groundwater and causing land to subsidence. To make natural gas production more sustainable, we need to figure out how we can better understand these problems. In this research project, we're going to study how natural gas and water flow through the tiny spaces (fractures) in coal, so we can better predict what might happen when we try to extract natural gas from underground. We will particularly be looking at how different extraction rates, fracture geometries, and fracture chemistry affect gas and water flow. The project will apply multi-level Monte Carlo techniques to optimise the design space for which computational multi-fluid dynamics simulations will be conducted.
Expected Outcomes and Deliverables:	The research scholar will gain experience with computational modelling techniques, stochastic modelling of complex environments, and have the opportunity to contribute to an academic publication. Students will be asked to produce an oral presentation to the research group at the conclusion of their project.
Suitable for:	This project is open to penultimate or final year students with experience in numerical modelling and exposure to the Linux operating system. Work is likely to be conducted on high performance computing facilities at UQ, so initial exposure to using a Linux terminal is very preferable.
Supervisor:	Dr Travis Mitchell t.mitchell@uq.edu.au
Further info:	Please send any enquiries to t.mitchell@uq.edu.au