THE UNIVERSITY OF SYDNEY

FACULTY OF ENGINEERING

PhD/MPhil Scholarship Opportunities 2026

Each of the projects listed below have a scholarship available funded by the supervisors' research grants and awards. Further scholarships are listed on the University **Scholarships** website.

If you are interested in a project, send the supervisor of a project an up-to-date CV, your transcripts, and a short description of why you are interested in the project.

This document was last updated on 5 August 2026.

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Aerospace, Mechanical and Mechatronic Engineering Projects

Australia's First High-Efficiency, Modular and Low-Cost Hydrogen Liquefaction and Storage System

Supervisor:

Dr Arman Siahvashi – arman.siahvashi@sydney.edu.au

Project Description:

Are you excited to advance innovative research in clean energy and fuel technologies and make a real difference? If so, we want to hear from you!

Global energy consumption is projected to rise nearly 50% by 2050. Hydrogen, as a clean and versatile energy carrier, can meet this demand and also enable deep decarbonization across energy and industrial sectors. By 2050, hydrogen demand is expected to grow six-fold. Australia's proximity to Asian markets presents a significant opportunity to lead in the emerging hydrogen export industry. Liquid hydrogen (LH_2), with its high energy density, is expected to play a crucial role in supply chains by reducing hydrogen's volume nearly 900 times through liquefaction, facilitating efficient storage and transportation. The liquid natural gas (LNG) industry serves as a benchmark for liquid hydrogen (LH_2) production due to similar cryogenic (low temperature) processes. As a leading LNG producer, Australia has a competitive advantage to develop an analogous LH_2 sector by leveraging existing knowledge, infrastructure, and supply chains. However, current hydrogen liquefiers lack the efficiency and cost-effectiveness needed to achieve rapid growth and development.

This project aims to advance the science necessary to overcome barriers in hydrogen liquefaction, enabling Australia to reliably produce and export clean energy. It addresses the gaps in fundamental knowledge in designing a cryogenic refrigeration cycle that combines the high efficiency of large-scale processes with the low cost, reliability, and safety of small modular systems. Leveraging expertise in cryogenics and liquefaction thermodynamics, the project will develop and demonstrate Australia's first modular hydrogen liquefier.

The major objectives of this project are:

1. Develop and model a new, more thermodynamically efficient hydrogen cooling cycle based on the Collins cycle, including demonstration of a high-efficiency cooling cycle using helium (or hydrogen) as a working fluid, shifting from traditional scale-up to modularization approaches;
2. Build a modular liquefier prototype featuring a novel floating piston expander and a heat-exchanger for high-pressure ratios and continuous flow, combining efficiency and compactness to enable low-cost, safer hydrogen liquefaction and zero-boil-off storage; and
3. Develop analytical models and user-friendly software to predict system performance, aiding scientists and engineers in understanding, designing, and assessing risks associated with modular hydrogen liquefaction units.

This project is conducted at the University of Sydney's School of Aerospace, Mechanical, and Mechatronic Engineering and involves hands-on experimental training and modelling to prototype an integrated system. Research activities include, but are not limited to, system design and modelling (numerical and CFD modelling), process and equipment design, sizing, material selection, safety and risk assessment, and the development of smart control systems and automation.

Offering:

- **Two scholarships** are available to domestic and international students, with priority given to domestic applicants. The scholarships are tax-free, cover tuition fees, and are for 3.5 years (full-time) at the RTP stipend rate of $42,754 (2026 rate).
- **Top-up scholarships** are available for strong and competitive candidates who demonstrate progress towards their PhD, serving as an additional award that complements the support received from the primary scholarship.
- **National and international travel opportunities** for conferences, site visits, exchange programs (e.g., Fulbright Scholarship or similar), and collaborations with scientists at the Massachusetts Institute of Technology and NASA.
- **Industry placement, networking, and career development opportunities** are available after the first year's confirmation of candidature for those who show good progress towards their PhD project.
- **Involvement in paid casual teaching and tutorials.**
- **Opportunities to engage in other research projects** (if interested and making reasonable progress in the main project) to gain experience in other areas.

Ideal candidates would have the following skills and experiences:

PhD Student 1 (Modelling-focused with involvement in experimental work)

- Tertiary qualifications in mechanical, chemical, process engineering, or a related field.
- Skills and previous experience in numerical modelling and analysis, computational fluid dynamics (CFD) and finite element analysis (COMSOL/ANSYS), and design optimization of fluids, energy, and heat/mass transfer systems.
- Proficiency in software development, including experience with Python, C/C++, or similar programming languages.
- Knowledge of thermodynamic and dynamic models and processes, including refrigeration cycles, is preferable.

PhD Student 2 (Experimental-focused with involvement in modelling work)

- Tertiary qualifications in mechanical, chemical, process, control systems engineering, or a related field.
- Skills in hands-on activities, mechanical design and development.
- Proficiency in using CAD/SolidWorks, MATLAB, LabView (control systems), and familiarity with manufacturing techniques.
- Experience in hands-on activities and experimental research, including procurement, material and equipment design and selection, testing, and commissioning.

While education and training will be provided for these projects, candidates possessing the above-mentioned skills and experiences are preferred and will be given priority.

In addition, we are looking for the following from all candidates:

- Conduct research and scholarly activities as part of a multidisciplinary research team
- Liaise effectively with both scientific and technical colleagues

- Assist researchers from other disciplines and collaborate with PhD students
- Communicate effectively and work collaboratively with others.
- Perform scientific research and produce academic writing for paper publications and thesis work
- Commence full-time as soon as possible.

How to Apply:

Please email **arman.siahvashi@sydney.edu.au** with the subject line "PhD Application: [*your Name]*" and include the following:

- CV
- Transcripts (can be unofficial)
- Your preference for PhD 1 or 2

Dissolved Oxygen Transfer by convective cooling in lakes and rivers

Supervisor:

Associate Professor Nicholas Williamson – **nicholas.williamson@sydney.edu.au**

Project Description:

Gaseous Oxygen is dissolved into the surface waters of rivers, lakes oceans and then mixed by turbulence within the water column. The turbulent mixing which controls this transfer rate is poorly understood in conditions of low wind and strong thermal stratification where convective cooling and other mechanisms are important. This project will investigate these effects through both experimental and numerical approaches.

Large scale fish kill events are an increasingly common occurrence in inland Australian rivers as a result of low dissolved oxygen (DO) levels. Rivers have significant DO demand for fish respiration and biological activity in the sediments and water column. Under normal conditions this DO demand is met by the continual transfer of gaseous oxygen from the atmosphere into the water surface, where it is then mixed through the water column by turbulence. When river flow is low however the water column can become thermally stratified and buoyancy effects damp out turbulent mixing thereby reducing DO transport from the surface. These conditions lead to DO depletion and fish kills. The gas transport process is very complex. Studies across a wide range of flows (lakes, oceans, rivers) have shown that

gas transfer from the surface is usually controlled by small scale mixing at the surface driven by larger scale turbulence within the water column. However, the dynamics of the turbulence, including how the turbulence is generated have a strong influence on the process and require separate parameterisations. The strongly stratified flow regimes seen leading up to fish kill events in Australian rivers are very different from conditions examined in most early investigations, so we are unable to predict DO supply into a water body before, during or after a fish kill event.

This project comprised of two main lines of investigation:

- Numerical research program which will use highly resolved direct numerical simulations to investigate the near surface mixing in strongly stratified river/lake flow under light wind forcing. The dynamics of convective cooling on gas transfer and the dynamics of non-breaking surface waves will investigated.

- A field program which will involve deploying high accuracy eddy covariance instruments to capture the turbulent oxygen and heat flux near the surface. Our well equipment fluid mechanics laboratory will be used for testing and development of instrumentation.

Successful candidates must:

Have a strong background in fundamental fluid mechanics, heat and mass transfer and numerical or experimental methods for fluid mechanics.

How to Apply:

To apply, please email nicholas.williamson@sydney.edu.au the following:

- CV
- Transcripts (can be unofficial)

Turbulent mixing in urban environments – towards trusted simulations under strongly stable and unstable conditions

Supervisor:

Associate Professor Nicholas Williamson – nicholas.williamson@sydney.edu.au

Project Description:

Using high resolution numerical simulations this project will advance our understanding of the effects of buoyant convection on turbulent mixing in urban environments (i.e. within city streets) and will develop new modelling approaches for large eddy simulations of these flows.

The modelling and simulation of urban environments is undergoing an extraordinary revolution. The increase in computational power currently available means that computational fluid dynamics simulations of an urban city block can be performed at ~ 5m resolution in near real time using Large Eddy Simulation (LES). This advancement has the capacity to revolutionise local weather prediction, decision making in urban planning and responses to natural and anthropogenic disasters, as well as address critical challenges such as urbanisation, urban heat islands and climate change. There are key deficiencies in current urban flow models that must be addressed however.

This project focuses on understanding the effect of buoyancy on street level mixing process. These process include convective boundary layers formed on streets and buildings and thermal plumes that discharge into the urban roughness layer. These processes are poorly represented in course resolution models. This project will use high resolution direct numerical simulation and high resolution large eddy simulations to understand the flow physics and develop new modelling strategies for them.

Successful candidates must:

- Have a strong interest in fundamental fluid mechanics, heat and numerical methods.
- Have a background in Engineering or Science/Mathematics is preferred.

How to Apply:

To apply, please email nicholas.williamson@sydney.edu.au the following:

- CV
- Transcripts (can be unofficial)

The fluid mechanics of particulate inhalation under various types of breathing

Supervisor:

Associate Professor Agisilaos Kourmatzis – agisilaos.kourtmatzis@sydney.edu.au

Project Description:

Our aim is to undertake a large-scale study to improve our understanding of the impact of particulate inhalation during exercise and/or extreme environmental conditions.

A range of potential directions for this project are possible, from developing an instrumented system that "models" particulate generation from a bushfire-like system, to computational modelling of inspiratory and expiratory flow and airway deposition, to implementation of laser-based diagnostics to improve our understanding of particulate flow processes during intense breathing. We have a degree of flexibility and can tune projects to leverage on your skill and interest. This is a highly multidisciplinary project that will be running across sites. There will be up to 3-4 PhD students working on this program over the next few years and you would be one of those students.

Offering:

This scholarship is offered to both international and domestic PhD applicants for 3.5 year (fulltime) at the RTP stipend rate of $42,754 p.a. (2026 rate) and includes tuition fees for international students.

Successful candidates must:

- Have a Bachelor degree (Honours or Honours Class 1 equivalent) or a Master degree,
- Have a strong background in fluid mechanics, optical diagnostics, instrumentation, experimental methods and/or computational fluid dynamics

How to Apply:

To apply, please email agisilaos.kourtmatzis@sydney.edu.au the following:

- CV
- Transcripts (can be unofficial)

Machine Learning-based 3D Object Detection for Navigation in Unstructured Environments

Supervisor:

Dr. Andrew Hill – andrew.hill@sydney.edu.au
Dr. Mehala Balamurali – mehala.balamurali@sydney.edu.au

Project Description:

The Australian Centre for Field Robotics (ACFR) at The University of Sydney, in collaboration with Rio Tinto, a global mining company, established the Rio Tinto Centre for Mine Automation (RTCMA) with an aim to develop and implement the vision of a fully autonomous, remotely operated mine.

Our research programs at RTCMA are dedicated to addressing critical challenges in the mining industry. For more detailed information about our research initiatives, please visit our website at https://www.sydney.edu.au/cma.

We are seeking a highly motivated and talented PhD student to join our research team in the field of machine learning for autonomous navigation, with a specific focus on 3D object detection in challenging,

unstructured environments. This project aims to investigate the application of deep neural networks to enhance the detection and tracking of objects in specialized domains, such as open-pit mines, where conventional approaches face unique challenges.

The primary objectives of this research project are as follows:

- Data Acquisition - Explore and evaluate two distinct methods for acquiring data suitable for training and evaluating deep neural networks. This includes semi-automated annotation of recorded LIDAR data and synthetic data generation.
- Object Detection - Develop and test various deep neural network architectures for the task of 3D object detection in unstructured environments, focusing on large, dynamic objects such as wheel loaders and excavators.
- Integration with Autonomous Platforms - Propose and implement a seamless integration of a ROS2 detector module into an autonomous driving platform, allowing real-time deployment and evaluation of the trained models in a practical setting.
- 3D Multi-Object Tracking - Extend the object detection work into 3D multi-object tracking to estimate the location, orientation, and scale of objects in the environment over time, considering temporal information to improve robustness against partial or full occlusions.
- Motion Pattern Analysis - Utilize the resulting object trajectories to infer motion patterns and excavation/driving/reversing behaviours, enabling enhanced forecasting and operational training for autonomous decision-making.

This research is expected to make the following contributions to the field of autonomous navigation:

- Novel methods for data acquisition and annotation in specialized domains.
- Proposed 3D object detection models for unstructured environments and for objects with dynamic shapes.
- Practical integration of deep learning models into ROS/ROS2 for real-world deployment.
- Advancements in 3D multi-object tracking techniques.
- Insights into motion patterns and behaviour analysis for autonomous decision-making.

At RTCMA, we are committed to advancing science and engineering in the field of mining through our specialised PhD Top-Up Scholarship. These scholarships are designed to provide exceptional graduates with unique opportunities to excel in their doctoral studies at University of Sydney.

Benefits of the RTCMA PhD Top-Up Scholarship:

- Access to our world-class team of scientists, engineers, and mentors in academia and industry.
- The opportunity to elevate your research to new heights using our state-of-the-art facilities.
- First-hand experience in an environment where groundbreaking research is actively contributing to positive changes in the mining industry.

Further information:

The RTCMA PhD Top-Up Scholarship is an additional award that complements the support received from a primary scholarship, such as an RTP scholarship.

Successful candidates must:

- Have a Bachelor degree (Honours or Honours Class 1 equivalent) or a Master degree,
- Have a strong background in computer vision, machine learning, or related fields, along with a passion for solving complex problems in autonomous navigation.

How to Apply:

To apply, please email andrew.hill@sydney.edu.au or mehala.balamurali@sydney.edu.au, with the subject line "RTCMA PhD Top-Up Opportunity" and your name. Include the following:

- CV and letters of recommendation,
- Transcripts (can be unofficial) and statement of purpose.

State Estimation and Planning in Dynamic Environments

Supervisor:

Dr Viorela Ila – viorela.ila@sydney.edu.au

Research Areas:

Robotics, Computer Vision, Optimization

Project Description:

In robotics, the conventional solutions for mapping dynamic environments focus on either trying to remove the data associated with moving objects, or detect and track the moving objects separately using traditional object tracking approaches. Ignoring dynamics in applications where the environment is cluttered with moving objects can drastically affect the safety of operations in such environments. Separately tracking moving objects, on the other hand, will produce representations of the world where the static and moving parts of the scene are decoupled. This can drastically affect the accuracy of the information used by the navigation and path planning algorithms, and in consequence the safe operation of autonomous vehicles.

The aim of this project is to develop an integrated framework to estimate and generate virtual representations of dynamic scenes that can be directly used by autonomous vehicles and intelligent systems to plan and perform tasks in a safe manner. https://robotics.sydney.edu.au/our-research/robotic-perception/

Further Information:

Successful candidates will have:

- A bachelor's degree in a relevant discipline
- Good mathematics and programming background.

How to Apply:

To apply, please email viorela.ila@sydney.edu.au, with the subject line "PhD Application:" and your name. Include the following:

- CV and cover letter
- Transcripts (can be unofficial)

Robotic Perception Lab Scholarships

Supervisor:

Dr Viorela Ila – viorela.ila@sydney.edu.au

Research Area:

Sensing, mapping and planning in dynamic environments.

Project Description:

The projects aim to develop and deploy on real robots theoretically well-founded solutions to robot localization, mapping and planning in dynamic environments.

Depending on interest and ability, candidates will investigate one or more of:

- Robust techniques for motion segmentation and tracking
- Novel spatial-temporal representations of dynamic environments
- Robust estimation and reconstruction of the dynamic scene
- Heterogeneous sensing for dynamic environments

Research Environment:

Embedded in the Australian Centre for Field Robotics, the Robotic Perception Lab is focused on delivering fundamental methodologies to sensing, mapping and planning in real-word dynamic environments.

The ACFR offers specialised labs and facilities, robotic platforms (underwater, agriculture, electric vehicles) and robotic field labs on-campus and in nearby off-campus sites. You will have access to mechanical and electronics workshops and a pool of technical staff to help realise your research ambitions. The University of Sydney offers a rich academic setting in a world class city, and the ACFR has strong ties to a network of nearby and international academic and industrial collaborators.

Further Information:

Successful candidates will have:

- A bachelor's degree in a relevant discipline
- Interest in robotics
- Strong background in mathematics and programming
- Excellent communication and interpersonal skills
- Hands-on experience with robotic platforms, ROS, Python, C++, and/or deep learning frameworks would also be an asset
- Creativity, curiosity, rigour and passion

How to Apply:

To apply, please email **viorela.ila@sydney.edu.au**, with the subject line "PhD Application:" and your name. Include the following:

- CV and cover letter and transcripts (can be unofficial)
- A link to a 2 minute video covering your strongest engineering, mathematical, programming skills and what you enjoy most about research**.**

Design and development of sustainable and high-performance alloys via nanostructure engineering

Supervisor:

Dr Xianghai An – **xianghai.an@sydney.edu.au**

Research Areas:

Materials Engineering; Metallic Materials; Mechanical Behaviour; Nanostructures; Infrastructure and transportation.

Project Description:

High-performance alloys are the backbone of decarbonising innovations in manufacturing, infrastructure, energy, and transportation. There is an accelerated demand for high-strength materials to produce lighter, more-reliable structural components. Stronger alloys will substantially improve mechanical and energy efficiencies, which can benefit our economy and environment directly. However, high-strength materials typically have low ductility and are more vulnerable to fracture. Furthermore, they are also susceptible to hydrogen embrittlement (HE) in many service environments for renewable energy applications such as hydrogen transportation and the bearings of wind turbines. Hydrogen-induced embrittlement can lead to unpredictable and catastrophic failures at relatively low applied stresses. These critical shortcomings cause serious safety concerns but cannot be readily addressed by traditional materials development approaches that generally render materials property trade-offs between strength and ductility/HE resistance.

Gradient structures are an emerging material-design paradigm inspired by nature that has great potential to overcome these alloy design trade-offs. This project aims to develop an innovative design strategy of gradient segregation engineering (GSE) to produce high-performance alloys by synergistically introducing a chemical gradient via grain boundary (GB) segregation and a physical gradient by nanostructure control. The novel GSE will entail a synergy of multiscale strengthening mechanisms that offer an exceptional strength-ductility combination and simultaneously enable the hierarchical HE-resisting mechanisms to notably enhance the hydrogen tolerance.

How to Apply:

To apply, please email **xianghai.an@sydney.edu.au** the following:

- CV
- transcripts
- brief description of motivation

Microstructure and Mechanical Behaviour of Advanced High-Entropy Alloys

Supervisor:

Dr Xianghai An - **xianghai.an@sydney.edu.au**

Research Area:

Advanced materials; nanoscale characterization; Nanomechanics

Project Description:

Unlike the traditional alloying strategies that are basically epitomised by the single-major-element approach, the novel metallugical design paradigm of high-entropy alloys (HEAs) is based on incorporating multi-principal elements in near equiatomic concentrations that generally form compositionally complex solid solutions. This new class of materials have triggered tremendous research interests in materials community since they empower us to break through to a new level of materials effectiveness's, which are difficult to attain in conventional alloys, and they open a new avenue of alloy design that has been little explored. In this project, we will apply advanced characterization techniques to understand the origins of their superior mechanical properties. The outcomes will not only advance our knowledge about the deformation mechanisms of HEAs, but also will create an empowering map for the mechanistic HEA design to push the property boundary of possibility for enriching their potential applications.

Offering:

This project is supported by Dr. Linlin Li's DECRA project. There are 2 scholarships available and if you are interested. Highly self-motivated candidates with background of mechanical and materials engineering are warmly welcomed.

How to Apply:

To apply, please email the following to **xianghai.an@sydney.edu.au** (Dr. Xianghai An, who will be the main supervisor and Dr Linlin Li's DECRA collaborator in USYD):

- CV
- transcripts
- brief description of why you are interested

Multiscale Modelling and Nondeterministic Optimisation for Reliable Stents

Supervisor:

Professor Qing Li – **qing.li@sydney.edu.au**

Research Area:

Finite element analysis and design optimisation; Biomechanics, Tissue engineering, Biomaterials; Additive manufacturing, Biofabrication

Project Description:

Multiscale Modelling and Nondeterministic Optimisation for Reliable Stents. Intravascular stents signify a class of lifelong micro-devices to support blood vessel for restoring circulation. Despite its remarkable initial outcome, the high rate of long-term mechanical failure remains a major concern. This project aims to study multiscale modelling and nondeterministic optimisation for a more reliable design of stents. It will tackle a series of fundamental yet challenging mechanics issues in design sensitivity for reliability analysis and optimisation. Those involve plasticity, fatigue damage and fracture across different length scales. The proposed nondeterministic optimisation is expected to minimise incidence of failure under uncertain conditions, thereby enhancing the longevity and reliability of stent therapy.

Further information:

Three scholarships are available for both international (if ranked high enough for tuition scholarship in the Faculty) and domestic students, immediately. Strong interest, motivation, and diligence are required for undertaking a high-quality PhD. Research experience would be preferable.

Microstructural-Functional Effect of Advanced Biomaterials (collaborated with SDI Pty Ltd)

Supervisor:

Professor Qing Li – **qing.li@sydney.edu.au**

Research Area:

Finite element analysis and design optimisation; Biomechanics, Tissue engineering, Biomaterials; Additive manufacturing, Biofabrication

Project Description:

Microstructural-Functional Effect of advanced biomaterials (collaborated with SDI Pty Ltd). This project aims to develop a fundamental understanding at the nanostructural level of the factors that contribute to the enhanced mineralisation and mechanical properties of dentine and enamel following the treatment

with silver diammine fluoride (SDF). A variety of advanced nanomechanical, tomographic and microscopic techniques will be used to characterise sound, carious and SDF treated tissue. The new biomechanical evidence on the underlying mechanisms, alternative protocols, delivery systems enable to optimise the treatment. The scientific insights into arresting/repairing damage processes will provide critical data for developing minimal intervention protocols for pediatric and geriatric populations.

Further information:

Three scholarships are available for both international (if ranked high enough for tuition scholarship in the Faculty) and domestic students, immediately. Strong interest, motivation, and diligence are required for undertaking a high-quality PhD. Research experience would be preferable.

Designing high-strength steels resistant to hydrogen embrittlement

Supervisor:

Prof. Simon Ringer **simon.ringer@sydney.edu.au**

Research Area:

Explore how to make metals safer for emerging hydrogen economy. You'll investigate how hydrogen weakens metals and help develop innovative, high-strength steels that are resistant to hydrogen-induced failure (hydrogen embrittlement).

Keywords: hydrogen embrittlement; microscopy; computation simulations

Project Description:

As the world moves toward a clean hydrogen economy, one major challenge is hydrogen embrittlement—an issue where metals can unexpectedly crack when exposed to hydrogen. Ensuring materials are safe and reliable is essential for storing, transporting, and using hydrogen. This PhD project will be part of Prof. Simon Ringer's ARC Linkage Project. The student will work with our international industrial partners from manufacturing and microscopy sectors, as well as academic collaborators. The student will explore how and why hydrogen causes these failures, helping to resolve long-standing questions about the underlying mechanisms. You will develop and apply advanced microscopy techniques to study materials at multiple levels down to atomic scale, focusing on how cracks start and grow, and how hydrogen interacts with defects inside metals. A key goal of the project is to design new, high-strength steels that can resist hydrogen embrittlement, using insights from experiments and computation simulations. This research will contribute to the development of safer, next-generation materials for the hydrogen future.

Further information:

The student will be trained, use and develop a broad range of skills and knowledge, including materials science, physical metallurgy, manufacturing, cutting-edge microscopy techniques, programming/AI/machine learning, and computation simulations.

We are seeking a highly motivated PhD student with strong enthusiasm for research in these areas, ideally supported under the RTP scholarship scheme.

How to Apply:

To apply, please **email simon.ringer@sydney.edu.au** and **suqin.zhu@sydney.edu.au**

Please provide us with your CV and transcript.

AI-Enhanced Optimisation of Prosthetic Devices for Tissue Reconstruction

Supervisors:

Professor Qing Li – qing.li@Sydney.edu.au

Professor Michael Swain – michael.swain@sydney.edu.au

Professor Jonathan Clark – jonathan.clark@lh.org.au

Professor Jeremy Crook – jeremy.crook@lh.org.au

Project Description:

Computational mechanics and structural optimisation transformational driving innovation in biomechanical design and personalised medicine. Yet a fundamental limitation in current load-bearing prosthetic design is that implantation substantially alters the surrounding biomechanical environment, initiating tissue remodelling processes that can compromise long-term treatment outcomes. Existing design frameworks typically optimise prostheses only for the immediate post-implantation condition, neglecting the dynamic adaptation of tissues such as bone, blood vessels, and ligaments.

This PhD project will develop a novel time-dependent computational design framework that integrates longitudinal imaging analysis with tissue remodelling models and advanced optimisation, including data-driven and AI-enhanced techniques. The research aims to enable next-generation customised, additively manufactured prosthetic devices that anticipate and adapt to long-term biological changes, thereby improving durability, functional integration, and clinical success.

Offering:

One fully funded and/or top-up PhD scholarship is available. Ideal candidates will have a strong background in mechanical, biomedical, AI, or computational engineering, with a keen interest in biomechanics and design optimisation. The successful applicant will work at the interface of computational engineering and translational medicine, collaborating closely with researchers and clinicians at the Sydney Medical School within an NHMRC Centre of Research Excellence, as well as with international partners at Tohoku University (Japan).

Biomechanical Role of Soft Tissue on Bone Remodelling - A Data-Driven Multiscale Modelling Study

Supervisors:

Professor Qing Li – qing.li@Sydney.edu.au

Professor Michael Swain – michael.swain@sydney.edu.au

Professor Ali Darendeliler – ali.darendeliler@sydney.edu.au

Professor Jonathan Clark – jonathan.clark@lh.org.au

Project Description:

A longstanding question in biomechanics is why orthodontic treatments apply very small forces (~1 N) to induce substantial bone remodelling, while prosthodontic loads that are three orders of magnitude higher (~1000 N) do not cause movement of dental implants. Resolving this paradox is critical to advancing dental, craniofacial and orthopaedic therapies.

This PhD project will develop innovative image-based, AI-enhanced multiscale computational models to investigate the mechanobiological role of connective soft tissues in bone adaptation. By integrating artificial intelligence with image-based remodelling algorithms across cellular, tissue, and structural scales, the research aims to uncover the fundamental mechanisms governing bone response under diverse mechanical environments. Positioned at the forefront of computational biomechanics, this project offers strong translational potential across orthodontics, orthopaedic, implantology, and regenerative therapies. The outcomes are expected to generate new fundamental insights while informing improved clinical strategies that could benefit a large patient population.

Offering:

One fully funded and/or top-up PhD scholarship is available. Ideal applicants will have a strong background in mechanical, biomedical, imaging, AI, or computational engineering, with a keen interest in cell mechanics and image-based computational modelling. The successful candidate will collaborate closely with researchers and clinicians at the Sydney Dental School within an NHMRC Centre of Research Excellence, gaining valuable interdisciplinary and clinical research exposure.

Multiscale Topology Optimisation for Additive Biomanufacturing of Tissue Scaffolds

Supervisors:

Professor Qing Li – qing.li@Sydney.edu.au

Professor Jonathan Clark – jonathan.clark@lh.org.au

Professor Jeremy Crook – jeremy.crook@lh.org.au

Project Description:

Additive manufacturing of multiscale periodic structures is transforming tissue engineering and regenerative medicine. Architected 3D scaffolds can be designed to provide not only mechanical support but also tailored biological environments that promote cell growth, vascularisation, and tissue regeneration. A related and equally important application is intravascular mesh-type stents, which act as permanent scaffolds to support blood vessels and restore circulation. However, achieving optimal mechanical integrity while ensuring efficient biological transport and long-term functionality remains a significant scientific and engineering challenge.

This PhD project will develop novel AI-enhanced, multiscale topology optimisation frameworks for additively manufactured periodic structures, including 2D mesh-type and 3D lattice architectures. The research will address critical design challenges in both cardiovascular stents and tissue scaffolds by establishing a data-driven, path-dependent optimisation methodology that bridges unit-cell and structural scales. By integrating mechanical performance with biotransport criteria, the project aims to enable the novel design and additive manufacturing for next-generation biofunctional scaffolds/stents with enhanced durability, adaptability, and regenerative potential.

Offering:

One top-up and one fully funded PhD scholarship are available. Ideal applicants will have a strong background in mechanical or biomedical engineering, AI, or computational engineering, with an interest in biomechanics and design optimisation. The successful candidate will work at the interface of computational mechanics, optimisation, and biomedical engineering, in close collaboration with the Sydney Medical School within an NHMRC Centre of Research Excellence. This project offers a unique opportunity for interdisciplinary research and clinical engagement, contributing to impactful innovations that advance both engineering science and human health.

Physics-Informed Design Optimisation of Flexible Mechanical Metamaterials

Supervisors:

Professor Qing Li – **qing.li@Sydney.edu.au**

Associate Professor Jianguang Fang – **Jianguang.fang@uts.edu.au**

Professor Grant Steven – **grant-steven@sydney.edu.au**

Project Description:

Mechanical metamaterials have emerged as a transformative class of architected materials whose extraordinary properties arise from structural design rather than chemical composition. By harnessing controlled kinematics, large deformation, and tailored stress–strain responses, these materials unlock unprecedented opportunities across engineering and biomedical applications.

This PhD project aims to advance the field through the development of novel computational optimisation algorithms and data-driven design frameworks for flexible mechanical metamaterials operating in the nonlinear regime. By systematically exploring large-strain behaviour, instabilities, and geometric nonlinearity, the research will significantly expand the attainable design space and enable richer, highly tuneable mechanical functionalities. The anticipated outcomes will drive technological innovation across a wide spectrum of applications, including soft robotics and adaptive systems, stretchable lithium-ion battery components, wearable and flexible medical sensors, arterial stents and soft biomedical implants, as well as cushioning insoles and advanced impact-mitigation materials. By integrating optimisation, machine learning, and advanced materials modelling, the project seeks to establish a new generation of intelligent, high-performance metamaterial systems with strong translational potential. The projects provide a dynamic and collaborative research environment, fostering partnerships with leading international institutions and industry.

Offering:

Two top-up or fully funded PhD scholarships are available. PhD candidates will work at the interface of computational mechanics, optimisation algorithms, machine learning, and architected materials design, with excellent prospects for high-impact publications and real-world impact. The successful candidates will collaborate closely with research teams at Harvard University (USA), gaining valuable international research exposure and professional development opportunities.

Topology-Optimised Active Structures for Next-Generation Intelligent and Responsive Systems

Supervisors:

Professor Qing Li – qing.li@Sydney.edu.au

Professor Grant Steven – grant-steven@sydney.edu.au

Dr Chi Wu – chi.wu@newcastle.edu.au

Project Description:

Active structures are a rapidly emerging class of engineered systems capable of dynamically responding to external stimuli such as mechanical loads, thermal changes, fluid flows, or magnetic and electrical signals. Unlike traditional passive structures, which only resist applied forces, active structures can adapt, self-regulate, and perform programmed functions, offering transformative opportunities in robotics, wearable devices, biomedical implants, and adaptive materials. Designing such systems requires advanced computational frameworks that integrate mechanical behaviour, material response, and multiphysics interactions, enabling structures that are not only strong and efficient but also intelligent and responsive to changing environments.

We are seeking two highly motivated PhD candidates to join an exciting research program focused on the next generation of active mechanical structural systems. The research addresses a fundamental challenge in the inverse design of active structures by developing novel topology optimisation algorithms within a nonlinearly coupled multiphysics framework. The students will contribute on development of a systematic computational design framework that expands capabilities in advanced structural engineering. The projects aim to unlock transformative applications in soft robotics, wearable and flexible devices, adaptive actuators, smart biomedical implants, and stimuli-responsive materials and systems.

Offering:

Two top-up and/or fully funded PhD scholarships are available. Successful candidates will work at the forefront of computational mechanics, structural optimisation, AI, and multiphysics modelling, gaining excellent opportunities for high-impact publications, international collaboration, and professional development. This is an outstanding opportunity to contribute to cutting-edge research with global relevance, while developing expertise in one of the fastest-growing areas of computational engineering.

PhD Positions in Computational Fluid Dynamics and Urban Flow Simulation

Supervisors:

Michael Kirkpatrick - michael.kirkpatrick@sydney.edu.au

Nicholas Williamson - nicholas.williamson@sydney.edu.au

Project Title:
Development of a GPU-Accelerated LES–RANS Framework for Multiphysics Simulation of Turbulent Dispersion, Droplet Dynamics, and Coupled Indoor–Outdoor Urban Flow in cities

Background:
Most of the world's population lives in urban environments – cities and towns of significant size. Our focus is on accurately simulating the air flow within these environments where the scales of interest extend from sub-meter scale street canyon processes to larger scale interactions with the urban boundary layer and the roughness layer.

These flows control the air quality, comfort and health of the city's inhabitants through the dispersion and removal of pollution and the regulation of street temperature by heat transfer and transport.

Engineers, urban planners and emergency responders need to be able to predict flows and in reasonable time. The growth in high performance computing resources, efficient computing architectures, and cutting-edge numerical methods offer the possibility of real time simulation at <1m scale.

The project team have developed a suite of high-speed computational fluid dynamics solvers to simulate flow in urban environments across different scenarios, including a massively parallel Large Eddy Simulation (LES) solver using a Lattice Boltzmann method and ultra-fast steady-state solvers using novel numerical methods and RANS turbulence models. We are now able to offer 3 new PhD positions on this project to extend the current modelling framework.

Project Description:
This project focuses on the development of numerical methods and simulation tools to advance our modelling framework. We have the following key areas to be addressed:
The development of multi-physics models for non-flow processes. Urban environments are complex environments, where heat and mass transfer, droplet transport and evaporation, coupling with atmospheric meteorological solvers and weather prediction data are all essential. This project will incorporate these modelling requirements into our solvers.
Development of a new coupled indoor and outdoor modelling framework. Current urban flow solvers universally consider only outdoor flow, but in many circumstances, the coupling between the internal building flows (in rooms and corridors) and the external urban flow is critical.

The Project Team: There are three PhD positions available on this project, each with differing focus. You would be joining an existing team of students in an active and post-doctoral research fellows. The project is led by three lead investigators: A/Prof. Nicholas Williamson, A/Prof. Michael Kirkpatrick and Prof. Steven Armfield. The project has active industrial collaborators who use the software developed to predict urban dispersion in a range of scenarios.

Skills Gained: Strong fundamental understanding of computational fluid dynamics, modelling physical systems, high performance computing, numerical methods, and fundamental fluid mechanics. The position involves working both individually and as part of a large team and collaborating with industry sponsors. Through the project you will develop strong communication and presentation skills.

Essential: 1. First-class honours degree in engineering, physics, mathematics with fluid mechanics, 2. Good English writing and communication skills, 3. Experience with scientific programming and data analysis (any programming language), 4. Strong interest in and motivation to study fluid mechanics, flow physics and numerical methods for fluid mechanics, 5. Australian Citizen or Permanent Resident.

Funding: A tax-free stipend of $42,754 p.a. (2026 rate) for up to 3.5 years. Other paid casual teaching and research assistant work may also available which can supplement this stipend. Project funds will cover conference travel and other project expenses.

How to apply:
Enquiries and applications should be made to A/Prof. Nicholas Williamson, nicholas.williamson@sydney.edu.au with the following materials:

1. Cover letter explaining your motivation and suitability, including details of prior research
2. CV
3. Undergraduate and masters transcripts with grades, 4. Details of two academic referees (including name, affiliation, and contact details).

Applications will be assessed as they are received and continue until the positions are filled.

Geometric Estimation and Control for Aerial Robotics

Supervisor:
Pieter van Goor - **pieter.vangoor@sydney.edu.au**

Background:
The aim of this project is to develop new estimation and control algorithms that are faster and more robust than the state of the art, and that can unlock the hardware's full capability in real-world outdoor environments.

Aerial robotic system hardware has become increasingly capable of high precision tasks involving interaction with their environment, including delivery, maintenance, and (physical) inspection. However, outside of laboratory environments, many of these tasks require human control or intervention due to the sensitivity of automatic control algorithms to the accuracy of on-board measurements.

Project Description:
The aim of this project is to develop new estimation and control algorithms that are faster and more robust than the state of the art, and that can unlock the hardware's full capability in real-world outdoor environments. Emerging theoretical techniques that exploit the mathematical symmetry of aerial robot dynamics provide a solution, but they are yet to be implemented in real-world systems. Depending on the candidate's skills and interests, there are opportunities to explore:

- Hardware implementations and testing of new control and estimation algorithms.
- Theoretical development of symmetry-based approaches.
- High-speed estimation using novel sensors (e.g. cameras, LIDAR, UWB range, etc.).

The Australian Centre for Robotics (ACFR) is a part of the School of Aerospace, Mechanical, and Mechatronics Engineering (AMME). The ACFR offers specialised labs and facilities, robotic platforms, and robotic field labs on-campus and in nearby off-campus sites. You will have access to mechanical and electronics workshops and a pool of technical staff to help realise your research ambitions. The University of Sydney offers a rich academic setting in a world class city, and the ACFR has strong ties to a network of nearby and international academic and industrial collaborators.

Desirable qualities in a candidate:

- Bachelor's degree with honours or master's degree in a relevant discipline, or evidence that a relevant degree will be obtained within the next six months.
- Interest in robotics and control.
- Strong background in mathematics and programming.
- Excellent communication and interpersonal skills.

- Hands-on experience with (aerial) robotic platforms, ROS, Python, C++.
- Creativity, curiosity, rigour and passion.

Funding:
3.5-year full scholarship is available at current 2026 RTP rate.

How to apply:
Your application must include:

- A cover letter (at most 1 page in length) stating your prior experience and research interest in relation to the topic of geometric methods for aerial robotics.
- A curriculum vitae with three references and a GPA.
- A transcript of bachelor's and master's degree grades (if applicable).

PhD Opportunity: High-fidelity Multi-physics Modelling for Digital Twins in Composite Manufacturing

ARC Discovery Project PhD Scholarship

We invite applications for a fully funded PhD position as part of an ARC Discovery Project focused on digital twins for advanced composite manufacturing. The project aims to improve process prediction, control, and understanding in resin infusion processes under uncertainty.

This PhD will investigate high-fidelity multi-physics computational approaches to modelling resin flow in laminated composite preforms using computational fluid dynamics, and resin curing and defect formation involving thermochemical simulation, and high-fidelity finite element modelling of composites with defects and its quantification. Specific research topics may include:

- Modelling of resin flow in laminated fibre preforms
- Multi-physics modelling of resin curing and defect formation
- High-fidelity finite element modelling of composites with selected and quantifiable defects

The candidate will join a cross-disciplinary team spanning computational mechanics, machine learning, and manufacturing science. Applicants should have:

- A bachelor's degree (Honours I or II) or master's degree in aerospace engineering, mechanical engineering, materials engineering or a closely related discipline.
- Strong background in computational fluid dynamics, heat transfer, finite element method.
- Strong interest in composite materials and manufacturing and machine learning methods.
- Willingness to undertake experimental research, including materials processing and laboratory testing, in addition to numerical simulation.
- Good communication skills and motivation to work in a multidisciplinary research team

This PhD is based at the University of Sydney with **Professor Liyong Tong** and forms part of a collaborative ARC Discovery Project with Professor Brian Falzon from Western Sydney University and Associate Professor Oliver Obst from the University of New South Wales. The student will benefit from joint supervision, collaboration and shared expertise across institutions.

Advanced Damping Fibre-Reinforced Polymer Composites

We invite applications for a fully funded PhD scholarship to join an exciting research project focused on the development of next-generation fibre-reinforced polymer (FRP) composites with enhanced damping capacity for aerospace and advanced structural applications, including aircraft and spacecraft systems. Modern aerospace structures demand lightweight materials with superior vibration and noise attenuation. This PhD project aims to develop novel composite damping technologies by exploiting multiscale and multifunctional fillers within polymer matrix composites.

The project will generate fundamental and applied knowledge on how synergistic interactions between different fillers can convert mechanical vibration into electrical energy and dissipate it internally—without external power or active control systems. Outcomes are expected to contribute to the design of multifunctional, lightweight, and energy-efficient structural materials for high-performance engineering systems.

The successful candidate will work on a combination of materials design, manufacturing, characterisation, and modelling,

Candidate Requirements:

- A bachelor's degree (Honours I or II) or Master's degree in
    - Materials Engineering
    - Mechanical Engineering
    - Aerospace Engineering
    - or a closely related discipline
- Strong interest in composite materials, multifunctional materials, or smart structures
- Willingness to undertake experimental research, including materials processing and laboratory testing
- Interest in mechanical testing, vibration/damping characterisation, and numerical modelling
- Good communication skills and motivation to work in a multidisciplinary research environment

Experience with polymer composites, piezoelectric materials, nanocomposites, or finite-element modelling is desirable but not essential.

Scholarship Details

- Stipend: In line with the Australian Government Research Training Program (RTP) rate
- Duration: 3–3.5 years (full-time)
- Additional support: Access to state-of-the-art materials fabrication, characterisation, and testing facilities, with opportunities for collaboration with aerospace and advanced manufacturing partners

Contact Professor Liyong Tong

Biomedical Engineering Projects

Pave the road for personalised therapy in Alzheimer's Disease – Harnessing advanced neuroimaging to map neurobiological heterogeneity

Supervisor:

Dr Jinglei Lv – jinglei.lv@sydney.edu.au

Project Description:

This project aims to leverage advanced neuroimaging and AI-driven analysis to identify individual "brain fingerprints" of Alzheimer's disease, enabling earlier detection and more precise, personalized therapeutic strategies.

Alzheimer's disease (AD) is highly heterogeneous, with patients showing diverse trajectories of cognitive decline, pathology, and treatment response. Current clinical tools fail to account for this neurobiological diversity, leading to inconsistent diagnoses and limited therapeutic success.

This project will apply state-of-the-art neuroimaging methodologies—including multimodal MRI (structural, diffusion, and functional imaging), lesion mapping, and connectomics—combined with machine learning approaches such as normative modelling and digital twin frameworks. By integrating large-scale imaging datasets (e.g., UK Biobank, ADNI, AIBL) with clinical and cognitive data, we aim to map distinct subtypes of AD, uncover early biomarkers, and predict disease progression on an individual level.

The ultimate goal is to translate these findings into clinically actionable tools that can guide precision therapies and improve patient outcomes.

Research techniques/technologies

Multimodal MRI (T1, fMRI, DWI), connectomics, lesion mapping, machine learning (normative modelling, deep learning), digital twin modelling.

Offering:

A scholarship for 3.5 years at the RTP stipend rate (currently $42,754 in 2026). International applicants will have their tuition fees covered.

Successful candidate must have:

- an Honours degree (First Class or First Class Honours Equivalent) or a Master's degree with a substantial research component
- a strong background in biomedical engineering, neuroscience, computer science, or related disciplines.
- experience with neuroimaging analysis, data science, or AI methods is desirable but not essential.
- an interest in precision medicine, brain health, and translational neuroscience.

How to Apply:

To apply, please email **jinglei.lv@sydney.edu.au** the following:

- A detailed CV, including academic qualifications, research experience and publications
- Academic transcripts

Understand the role of ascending arousal system in cognitive decline and delirium and drive therapeutic advances

Supervisor:

Dr Jinglei Lv – **jinglei.lv@sydney.edu.au**

Project Description:

This project investigates how disruptions in the ascending arousal system contribute to cognitive decline and delirium, aiming to identify novel therapeutic targets and improve clinical outcomes.

The ascending arousal system (AAS) plays a fundamental role in maintaining attention, wakefulness, and higher-order cognition. Dysfunction in this system has been increasingly linked to age-related cognitive decline and the onset of delirium, a common and serious postoperative and acute condition in older adults. Despite its importance, the precise mechanisms by which the AAS contributes to cognitive impairment remain poorly understood.

This project will combine advanced neuroimaging, physiological monitoring, and computational modelling to characterise structural and functional changes within the AAS. Multimodal MRI and connectomics will be integrated with clinical and cognitive assessments to uncover biomarkers that predict vulnerability to delirium and long-term decline. By mapping these pathways and identifying key neural correlates, the project aims to inform personalised interventions and drive the development of novel therapeutic strategies.

Research techniques/technologies

Multimodal MRI (structural, diffusion, functional), connectomics, neurophysiology, computational modelling, machine learning.

Offering:

A scholarship for 3.5 years at the RTP stipend rate (currently $42,754 in 2026). International applicants will have their tuition fees covered.

Successful candidate must have:

- an Honours degree (First Class or First Class Honours Equivalent) or a Master's degree with a substantial research component
- a background in biomedical engineering, neurosciences, computer science, psychology, or related field
- experience with neuroimaging or data science methods desirable but not required.
- a strong motivation to contribute to translational brain health research.

How to Apply:

To apply, please email **jinglei.lv@sydney.edu.au** the following:

- A detailed CV, including academic qualifications, research experience and publications
- Academic transcripts

Artificial Intelligence for Neuroscience and Brain Health

Supervisor:

Dr Jinglei Lv – **jinglei.lv@sydney.edu.au**

Project Description:

This project leverages cutting-edge AI - including large language models (LLMs) and foundation models - to accelerate discoveries in neuroscience and develop precision approaches for brain health.

Artificial Intelligence (AI) is transforming neuroscience by enabling new ways to model brain structure, function, and cognition. The next generation of AI - foundation models and LLMs - offer unprecedented opportunities to integrate multimodal data (e.g., neuroimaging, genomics, clinical records, behavioural data) and generate personalised, interpretable insights into brain health.

This project will explore how LLMs and foundation models can be tailored for neuroscience, including:

- Neuroimaging analysis: Using foundation models to learn shared representations across MRI, fMRI, DTI, and PET for improved diagnosis and prognosis of brain disorders.
- Knowledge integration: Applying LLMs to synthesise biomedical literature, clinical notes, and multi-omics data to uncover new disease mechanisms.
- Digital brain twins: Developing personalised foundation models that capture individual variability, predict disease trajectories, and guide therapeutic strategies.
- Interpretability and trust: Designing explainable AI tools that link model predictions to neurobiological mechanisms, ensuring clinical reliability.

By uniting AI innovation with neuroscience, the project aims to build a new generation of computational tools that advance understanding of the healthy and disordered brain while driving precision medicine in brain health.

Research techniques/technologies

Large language models (LLMs), foundation models, deep learning, graph neural networks, neuroimaging (MRI, fMRI, DTI, PET), multimodal integration, digital twin modelling.

Offering:

A scholarship for 3.5 years at the RTP stipend rate (currently $42,754 in 2026). International applicants will have their tuition fees covered.

Successful candidate must have:

- an Honours degree (First Class or First Class Honours Equivalent) or a Master's degree with a substantial research component in Computer Science, Biomedical Engineering, Neuroscience or related disciplines
- have strong coding and analytical skills (Python, PyTorch/TensorFlow).
- have an interest in AI for healthcare, neuroscience, and translational applications.

How to Apply:

To apply, please email **jinglei.lv@sydney.edu.au** the following:

- A detailed CV, including academic qualifications, research experience and publications
- Academic transcripts

System Design and Optimisation for Plasma Processing Research Translation

Supervisor:

Professor Marcela Bilek – **marcela.bilek@sydney.edu.au**

Research Areas:

Plasma, System Design, Surface Modification

Project Description:

Project will focus on designing, building, testing and validating pilot scale up systems based on plasma principles, diagnostics and models.

Our research has identified a number of novel surface treatments and demonstrated that they can provide significant value across a range of biomedical and industrial applications. Current research is focussed on developing scaled up plasma systems to translate these research achievements into real-world products and services for positive impact. Applications include next generation cell culture platforms, medical diagnostic kits, and medical implants. These plasma treatments can be conducted with either low, or atmospheric pressure plasma systems, and can create plasma polymerised nanoparticles (PPN) of great interest for pharmaceutical applications. Candidates will conduct research in collaboration with industry partners, such as Culturon (https://www.culturon.com.au/), translation organisations, such as the SMART CRC (**https://smartcrc.com.au/**), and complementary research organisations.

The successful candidate will conduct plasma process diagnostics, surface modification experiments including surface characterisation and hardware modifications to achieve the desired plasma conditions in scaled systems. A key goal is gaining deeper understanding of and discovering ways to improve the plasma processes and treatments. Considerations include gas flow dynamics, electric fields, gas composition, parasitic discharges, optimisation of system geometries, plasma density analysis, deposition rates, tuning the chemical composition of coatings, complex surface geometries, treatment consistency etc.

The successful candidate will help bring cutting edge technology to patients, customers, and businesses for global benefit.

Offering:

The successful candidate will be awarded a scholarship for 3.5 years at the RTP stipend rate (currently $42,7534in 2026) subject to satisfactory academic performance. International applicants will receive a tuition fee scholarship for up to 3.5 years.

Successful candidate must have:

- an Honours degree (First Class or First Class Honours Equivalent) or a Master's degree with a substantial research component
- Demonstrated lab experience & research excellence from an Honours, or Master’s degree including substantial research.
- Sufficient proficiency in physics, engineering, and surface science to conduct relevant hands-on experiments.
- Proficiency in scientific writing and oral communication.
- The capacity to work proactively and professionally within a team.
- Preferably existing proficiency with plasma systems, including vacuum systems, high voltage pulsed power and plasma diagnostics, such as optical emission spectroscopy (OES) and Langmuir probes.
- Preferably existing proficiency with 3D printing and/or advanced manufacturing.
- Preferably experience with surface analysis techniques, including FTIR, XPS, SEM, AFM, profilometry, etc.
- Preferably experience working with industry partners
- Preferably experience working on multidisciplinary/interdisciplinary projects. Ideally biomedical, or clinical.

How to Apply:

To apply, please email **marcela.bilek@sydney.edu.au** the following:

- CV
- Transcripts

Computational Modelling for Plasma Research Translation

Supervisor:

Professor Marcela Bilek – marcela.bilek@sydney.edu.au

Research Areas:

Fluid Dynamics, Computational Modelling, Plasma

Project Description:

Project will focus on developing computational models to understand, predict, and optimise plasma surface treatment processes for scale-up from laboratory systems to pilot and industrial platforms.

Our research has identified a number of novel surface treatments and demonstrated that they can provide significant value across a range of biomedical and industrial applications. Current research is focussed on developing scaled up plasma systems to translate these research achievements into real-world products and services for positive impact. Applications include next generation cell culture platforms, medical diagnostic kits, and medical implants. These plasma treatments can be conducted with either low, or atmospheric pressure plasma systems, and can create plasma polymerised nanoparticles (PPN) of great interest for pharmaceutical applications. Candidates will conduct research in collaboration with industry partners, such as Culturon (https://www.culturon.com.au/), translation organisations, such as the SMART CRC (https://smartcrc.com.au/), and complementary research organisations.

The successful candidate will develop computational models to provide deeper understanding of the plasma behaviour and make robust predictions for scale up experiments to guide hardware modifications. Considerations include gas flow dynamics, electric fields, gas composition, parasitic discharges, optimisation of system geometries, plasma density analysis, deposition rates, tuning the chemical composition of coatings, complex surface geometries, treatment consistency etc. Computational modelling when validated by comparison with experimental studies provides a highly efficient way of exploring and optimising designs and operational parameters.

The successful candidate will help bring cutting edge technology to patients, customers, and businesses for global benefit.

Offering:

The successful candidate will be awarded a scholarship for 3.5 years at the RTP stipend rate (currently $42,754 in 2026) subject to satisfactory academic performance. International applicants will receive a tuition fee scholarship for up to 3.5 years.

Successful candidate must have:

- Must have an Honours degree (First Class or First-Class Honours Equivalent) or a Master's degree with a substantial research component
- Demonstrated computational modelling & simulation experience with fluid dynamics and/or electric/magnetic fields. Direct experience modelling plasma is an advantage.
- Proficiency with modelling software and techniques, such as COMSOL, and finite element modelling.
- Experience with validating models with experimental data.
- Sufficient proficiency in physics, engineering, and surface science to understand and design appropriate simulations and models.
- Proficiency in scientific writing and oral communication.
- The capacity to work proactively and professionally within a team.

- Preferably some experience with complex computational modelling / plasma systems / 3D printing / surface science.
- Preferably experience working with industry partners
- Preferably experience working on multidisciplinary/interdisciplinary projects, ideally biomedical, or clinical.

How to Apply:

To apply, please email marcela.bilek@sydney.edu.au the following:

- CV
- Transcripts

AI – Driven Prediction of Scaffold Performance for Bone Regeneration

Supervisor:

Professor Hala Zreiqat – hala.zreiqat@sydney.edu.au

Project Description:

The project, co-supervised by Prof. Zhiyong Wang (Computer Science) and Prof. Hala Zreiqat (Biomedical Engineering) and A/Prof Zufu Lu, is at the forefront of AI applications in regenerative medicine. It will investigate advanced deep learning techniques to predict cell fate and scaffold outcomes using temporal omics and imaging data.

The key research components include:

- Multi-level performance evaluation to minimize overfitting and improve model generalizability using in-silico and independent public datasets.
- Modelling of morphological and molecular changes during cell differentiation using AI-based temporal modelling and evolving neural networks.
- Prediction of scaffold performance in bone regeneration using multi-modal data integration and generative AI.

This work will contribute to transforming how biomaterial scaffolds are designed and assessed, with broad implications for regenerative therapies and personalized medicine.

Offering:

This opportunity is only open to students who receive a Research Training Program (RTP) Scholarship.

The successful candidates must:

- Have a Honours degree (First Class or First Class Honours Equivalent) or a Master's degree with a substantial research component in computer science, biomedical engineering, bioinformatics, data science, or a related field.
- Have strong programming and analytical skills (e.g., Python, deep learning frameworks).
- Demonstrate research aptitude and excellent communication skills in English.
- Show a keen interest in interdisciplinary research at the interface of AI and biology. Previous research experience, including thesis or project work in relevant areas, is desirable.

Outstanding final-year undergraduate students who expect to graduate this year with first-class honours are encouraged to apply, and commencement of the position can be arranged upon completion of their degree.

Successful applicants will have access to:

- Cutting-edge experimental and computational facilities.
- Interdisciplinary supervision and mentoring.
- Funding to present at national and international conferences.

How to Apply:

To apply, please email Zhiyong.wang@sydney.edu.au and hala.zreiqat@sydney.edu.au / zufu.lu@sydney.edu.au with the following:

- A brief cover letter expressing your interest and suitability
- Your CV, including academic transcripts and details of any research experience

Expressions of interest will be reviewed on a rolling basis until the position is filled.

Lameness detection and characterisation in athlete horses

Supervisor:

Dr Andre Kyme – andre.kyme@sydney.edu.au

Project Description:

The goal of this project is to develop an end-to-end neural network solution for lameness characterisation in athlete horses based on video data. It will enable the detection and prevention of catastrophic injuries much more reliably than current methods. The project requires a strong background in Python and neural network principles and architectures.

Collaborator: Peter Tually and Chris Cowcher, TeleMedVet, Perth, Western Australia.

Note:

- Projects are available to scholarship holders only
- $5k-10k /annum top-up is available to eligible scholarship holders
- 6-12 month visits to collaborating partner institutions is possible for relevant projects

For more information contact andre.kyme@sydney.edu.au

Advanced motion tracking for motion-compensated positron emission tomography

Supervisor:

Dr Andre Kyme – andre.kyme@sydney.edu.au

Project Description:

The goal of this project is to design and optimise motion tracking capability for the MousePET scanner, a next-generation system for simultaneous brain imaging and behavioural analysis in freely moving rodents. Motion tracking is a crucial component of motion-corrected brain imaging and has particularly challenging specifications for this application. The MousePET system will be the first of its kind and will dramatically enhance the types of experiments exploring the relationship between brain function and behaviour in mammals.

Collaborator: Prof Simon Cherry, University of California Davis, USA

Note:

- Projects are available to scholarship holders only
- $5k-10k /annum top-up is available to eligible scholarship holders
- 6-12 month visits to collaborating partner institutions is possible for relevant projects

For more information cont**act** andre.kyme@sydney.edu.au

AI-based motion correction for PET brain studies

Supervisor:

Dr Andre Kyme – andre.kyme@sydney.edu.au

Project Description:

The goal of this project is develop a complete pipeline for neural network-based motion correction of brain PET studies in the image domain. A solution will require novel data simulation approaches, neural network architectures and clever use of multi-modal data. It will facilitate much easier clinical translation of motion correction than hardware-based approaches, and enable massive archives of legacy PET data to be reprocessed.

Collaborator: Prof Arman Rahmim, University of British Columbia, Canada

Note:

- Projects are available to scholarship holders only
- $5k-10k /annum top-up is available to eligible scholarship holders
- 6-12 month visits to collaborating partner institutions is possible for relevant projects

For more information **c**ontact andre.kyme@sydney.edu.au

BREEZE: Better neuroimaging for children with cerebral palsy

Supervisor:

Dr Andre Kyme – andre.kyme@sydney.edu.au

Project Description:

The goal of this project is to translate prospective MRI head motion correction to the clinic in combination with eye-gaze technology, enabling accurate brain imaging of children with CP without the need for sedation and with the benefit of eye-gaze communication with caregivers and technologists. This technology would dramatically improve the experience for these children and expand the options for families to have routine brain imaging for diagnosis and treatment monitoring.

Note:

- Projects are available to scholarship holders only
- $5k-10k /annum top-up is available to eligible scholarship holders
- 6-12 month visits to collaborating partner institutions is possible for relevant projects

For more information contact andre.kyme@sydney.edu.au

Unobtrusive Sensor Systems for Healthcare

Supervisor:

Professor Wei Chen – **wei.chenbme@sydney.edu.au**

Research Areas:

Wearable sensors, unobtrusive sensing, embedded systems, health monitoring.

About the project:

This project aims to create unobtrusive sensor systems to monitor physiological and behavioural data of human body. The signals include EEG, ECG, EOG, EMG, respiration, SpO2, temperature, activities, etc.. The candidate will develop innovative wearable sensing or non-contact sensing techniques with new sensing materials and embedded systems for biomedical data acquisition and processing. Lightweight AI algorithms and software for embedded sensor systems will be proposed for intelligent healthcare systems. The potential applications will be sleep monitoring, neonatal monitoring and smart rehabilitation, etc..

Successful candidates must have:

- Bachelor's or a Master's degree majoring in electrical and electronic engineering, biomedical engineering, microelectronics, telecommunication engineering, mechanical engineering, computer engineering and related disciplines,
- Good at circuit and system (PCB) design,
- Good communication skills,
- Good at teamwork and collaboration.

How to Apply:

If you are interested, please email a copy of your transcript and CV to **wei.chenbme@sydney.edu.au** with the subject line "PhD Application:" to discuss your suitability for this project.

Data Processing and AI for Health Monitoring

Supervisor:

Professor Wei Chen – **wei.chenbme@sydney.edu.au**

Research Areas:

Signal processing, AI and deep learning, sleep staging and sleep disease analysis.

About the project:

This project focuses on development of signal processing and AI methods and algorithms for sleep staging and sleep disorder analysis. The scope will include proposing dedicated AI and data science methods to explore and analyse relevant biomarkers and features with high sensitivity and specificity from physiological and behavioural signals; building data analytical models to enhance the learning performance, proposing approaches to improve model generalization; investigating explainable AI methods; developing information and computing schemes and algorithms for precise sleep disease detection and prediction.

Successful candidates must have:

- Bachelor's or a Master's degree majoring in computer and data science, electrical and electronic engineering, biomedical engineering, microelectronics, telecommunication engineering, and related disciplines,
- Good at signal processing and AI technologies,
- Good communication skills,
- Good at teamwork and collaboration.

How to Apply:

If you are interested, please email a copy of your transcript and CV to **wei.chenbme@sydney.edu.au** with the subject line "PhD Application:" to discuss your suitability for this project.

Real-time Low-power Neural Accelerator

Supervisor:

Associate Professor Omid Kavehei – **omid.kavehei@sydney.edu.au**

About the project:

This project aims at developing an Application-Specific Integrated Circuit (ASIC) for a low-power learning system processing real-time time-series data.

For over a decade, the semiconductor industry, that propelled us all into the digital age, has been struggling with a chip power-density crisis. The birth of multi-cores microprocessors has its root in this very challenging issue of fundamental physics. The known thermal-voltage (kT/q) parameter, which identifies the scalability of basic transistor parameters, is a non-scalable factor. Additionally, the minimum feature size of the transistors has continuously shrunk from 10µm in 1970 to just 14nm in 2015 (iPhone 6S was shipped with 14nm transistors) making it extremely difficult and costly to engineer energy barriers in transistor channels (where electrons move) to avoid excessive electron tunnelling through the barrier when the transistor is supposed to be OFF. Success of the industry has traditionally been measured by how effectively they avoid quantum mechanical effects, such as the tunnelling. Unfortunately, with a few tens of atoms across a sub-10nm transistor switch, such effectiveness is vanishing into the shadow of ever increasing quantum tunnelling. This project aims to develop a neuro-inspired computing platform for cognitive task that current supercomputers fail to do in real-time like human brain [1-3]. The system architecture is inspired by how the brain function and solely dedicated to tasks dealing with big-data, including data mining, data analytics, pattern recognition and feature extraction. We use our state-of-the-art GPU cluster to develop the software and integrated circuit design tools to explore hardware implementation.

How to Apply:

If you are interested, please email a copy of your transcript and CV to **omid.kavehei@sydney.edu.au** with the subject line "PhD Application:" to discuss your suitability for this project.

Low-power Intelligent Bio-Signal Processing

Supervisor:

Associate Professor Omid Kavehei – **omid.kavehei@sydney.edu.au**

About the project:

This project aims at developing a responsive implant that is making decisions based on smart bio-signal processing.

While artificial intelligence (AI) has paved its way to some bionic applications mostly through software post-processing, close to none of today's electronic implants can be named "Intelligent"! We believe with the large amount of data that is available in any medical field and remarkable advances in AI and the expertise that we have in that as well as electronic technology shrinkage to a remarkable scale, there is a real chance that we may ultimately be able to let an implant to "learn and understand" streams of neural data and make decision with high accuracy. There are software and hardware expertise exist in our side that requires to be matched with medical knowledge, expertise and data. With that in mind please find the following proposal for collaboration [1-4].

This project aims to (A) introduce a deep learning platform for prediction of anomalies before it causes alteration of consciousness or other damages, (B) implement an ultra-low power fully digital and fully customized chipset to parallel achieved software performance, (C) mitigate problems of 'false alarms' and 'delay in action' confirmed using a set of clinical trials.

This project uses our state-of-the-art GPU cluster to develop the software and integrated circuit design tools to explore hardware implementation. We also study packaging and high-level integration and surgery issues for full animal clinical trial.

How to Apply:

If you are interested, please email a copy of your transcript and CV to **omid.kavehei@sydney.edu.au** with the subject line "PhD Application:" to discuss your suitability for this project.

Data-intensive solutions for medical technologies

Supervisor:

Associate Professor Omid Kavehei – **omid.kavehei@sydney.edu.au**

About the project:
This project aims at developing advanced solutions in software for processing medical data, addressing the issue of less or no labelled data.

Using today's advances in machine intelligence and pattern recognition, and our incredibly massive amount of structured and unstructured data on central nervous systems and the Brain, making sense of massive datasets with high amount of data-noise and incoherency is now a possibility [1-3]. We will develop, test and implement cognitive computing technologies in data-driven medical contexts. This project aims to develop data-driven machine learning medical technologies to make medical practices more personalized and precision in both domains of medical devices and services. While expanding knowledge in the information and computing sciences, this project aims to massively reduce costs in health and support services as well as providing low-cost bed-side or wearable technologies for constant monitoring and notification systems. This project uses our state-of-the-art GPU cluster to develop these technologies.

How to Apply:

If you are interested, please email a copy of your transcript and CV to **omid.kavehei@sydney.edu.au** with the subject line "PhD Application:" to discuss your suitability for this project.

Real-time cell mass identification of cellular processes to build the next generation of diagnostics

Supervisor:

Dr David Martinez Martin – david.martinezmartin@sydney.edu.au

Research Area:

Nanobiotechnology; Cellular biophysics; Physical Biology

Project Description:

Cell growth and mass regulation is a fundamental process for all living organisms, yet it is poorly understood – partly due to our inability to detect changes in mass at cellular level. We develop technologies that measure and monitor cell growth in real time at the single-cell level, enhancing our understanding of cell development. Considering that dysregulation of cell mass is a critical underlying force in the development and progression of many diseases, understanding how cells regulate their mass has enormous potential to transform the way we diagnose, monitor and treat disease conditions such as cancer, diabetes, obesity, cardiovascular disease, ageing or infectious diseases. Our research is at the interphase of engineering, biology and physics, and involves working with exciting methods and techniques of microfabrication, nanotechnology, advanced optical microscopies, programming, cell biology, atomic force microscopy, etc.

Artificial intelligence (AI) assisted single-cell biomechanical nanotools for cardiovascular mechanobiology

Supervisor:

Associate Professor Arnold Lining Ju, Snow Fellow GAICD FHEA – arnold.ju@sydney.edu.au

Research Area:

Mechanobiology, Cardiovascular Engineering, Single molecule, Artificial intelligence, Piezo

Project Description:

The dynamism and intricacy of protein complexes performing critical physiological functions present a significant challenge. Traditional biochemical and biophysical techniques often falter in visualizing and characterizing their kinetic and signalling processes on singular living cells. The pressing need is for advanced bioimaging and single-molecule manipulation technologies capable of observing life activities in native cellular environments at the nanoscale.

Over the past half-decade, Dr. Ju has been at the forefront of this evolution, pioneering the pico-force (10^-12 Newton) BFP technique in Australia, the first of its kind. With this revolutionary nanotool, groundbreaking insights have been attained into the mechanosensory proteins' inner mechanics, as evidenced by a myriad of esteemed publications.

This ambitious project envisions the fusion of BFP with artificial intelligence to give birth to an unparalleled BFP manipulation platform. An ambitious vision for the future aims to marry the platform with patch clamp

technology, enabling a trifecta of single-molecule electrophysiology, imaging, and manipulation within one system.

This initiative's pinnacle will be its application to the groundbreaking 2021 Nobel Prize discovery — Piezo mechanosensitive ion channels. The goal? To illuminate their role in cardiovascular diseases, especially in blood clotting phenomena, and pioneer new anti-thrombotic therapeutic strategies. Furthermore, this research stands poised to usher in a new era in biosensing device design, optimizing the human-machine interface.

Further information:

We are looking for candidates with the following skills and experience:

- Academic knowledge in the discipline of biophysics, biomechanics, electrophysiology, cell biology and biochemistry.
- Experience of instrumenting or operating single-molecule force spectroscopies such as atomic force microscopy, optical tweezers, magnetic tweezers, patch clamp electrophysiology systems, micromanipulation and microinjection systems, or other biomedical experimental devices such as rheometers and parallel plate flow chambers.
- Familiar with using two or more of Labview, ImageJ, AutoCAD, MATLAB, 3D-max, PRO-E, SolidWorks and other software.

Preferred experience includes:

- Solid basic knowledge of biology and hands-on experience in PC2 biological laboratory, using flow cytometer, ELISA, Western blots, protein-protein interaction assays, protein/antibody purification and functional characterisations.
- Capability of independently output processing models and drawings, be capable of CNC programming, use other conventional processing platform equipment to manufacture mechanical parts, and use 3D printers for part manufacturing.
- Pre-doctoral track records with publications, conference papers, reports, professional or technical contributions with evidence of independent research ability.
- Excellent oral and written communication skills.

To learn more about the Snow-Ju Lab: Mechanobiology and Biomechanics Laboratory (MBL) and our research, please visit our official website (https://snowmedical.org.au/fellow/lining-arnold-ju/). For more information on A/Prof Ju's Snow Fellowship and groundbreaking research, check out these public release news articles:

A father had a heart attack at 54. His son's technology could have predicted it (https://www.smh.com.au/national/nsw/a-father-had-a-heart-attack-at-56-his-son-s-technology-could-ve-predicted-it-20230327-p5cvkj.html)

How to Apply:

If you are interested in this opportunity, you can complete your Expression of Interest via https://sydney.au1.qualtrics.com/jfe/form/SV_5vSA2po0sooUt0i**,** additional enquires can be emailed to **arnold.ju@sydney.edu.au** with the subject line "PhD Application" and the project title in the body of the email.

Harnessing Ancient Chinese Movable Type 3D Printing for Point-of-Care Microfluidic Diagnostics in Cardiovascular and Cerebrovascular Diseases

Supervisor:

Associate Professor Arnold Lining Ju, Snow Fellow GAICD FHEA – arnold.ju@sydney.edu.au

Research Areas:

Microfluidics, Point of care, Vessel on chip, Mechanobiology, Thrombosis

Project Description:

Thrombosis, resulting in devastating cardiovascular diseases such as heart attacks and strokes, stands as the predominant global killer. A particularly challenging variant, Cerebral venous sinus thrombosis (CVST), has been thrust into the spotlight due to its links with stroke and the observed complications from certain COVID-19 vaccines.

It's long-established that platelets play a central role in thrombosis. However, our latest research has unveiled a biomechanical prothrombotic mechanism that underscores platelets' sheer sensitivity to blood flow disturbance gradients. Alarmingly, prevalent anti-thrombotic drugs such as Aspirin, Plavix®, or Brilinta®, present limited efficacy against this mechanism.

Our team, based at the state-of-the-art Biomedical Engineering School and the Charles Perkins Centre, seeks to address this critical gap. Integrating principles from the ancient "Chinese Movable Type" printing with modern microfluidic biochip design, we've conceptualized the Vein-Chip platform. This innovative tool can simulate patient-specific CVST vascular anatomy using magnetic resonance imaging (MRI), coupled with the associated haemodynamic flow profile. This cost-effective, rapid, and scalable chip paves the way for personalized thrombotic assessment and monitoring, holding significant promise for a clinical breakthrough.

Further information:

We are looking for candidates with the following skills and experience:

- Academic knowledge in the discipline of biophysics, biomechanics, electrophysiology, cell biology and biochemistry.
- Capability of using two or more of ANASYS, Comsol, Labview, AutoCAD, MATLAB, 3D-max, PRO-E, SolidWorks, ZEMAX and other software.
- Experience with the use of computational fluid dynamics (CFD) for haemodynamics or PIV analysis of haemorheology.

Preferred experience includes:

- Minimum one-year expertise in clean room micro/nano processing and soft lithography.
- Experience with theoretical simulation using Matlab, Comsol, or Labview programming for equipment and device control.
- Proficiency in creating processing models, CNC programming, mechanical part manufacturing, and 3D printing.
- Pre-doctoral accomplishments such as publications, conference papers, and evidences of independent research.
- Outstanding oral and written communication skills.

To learn more about the Snow-Ju Lab: Mechanobiology and Biomechanics Laboratory (MBL) and our research, please visit our official website (https://snowmedical.org.au/fellow/lining-arnold-ju/). For more

information on A/Prof Ju's Snow Fellowship and groundbreaking research, check out these public release news articles:

A father had a heart attack at 54. His son's technology could have predicted it (https://www.smh.com.au/national/nsw/a-father-had-a-heart-attack-at-56-his-son-s-technology-could-ve-predicted-it-20230327-p5cvkj.html)

How to Apply:

If you are interested in this opportunity, you can complete your Expression of Interest via https://sydney.au1.qualtrics.com/jfe/form/SV_5vSA2po0sooUt0i, additional enquires can be emailed to **arnold.ju@sydney.edu.au** with the subject line "PhD Application" and the project title in the body of the email.

Artificial intelligence (AI) assisted novel design and molecular dynamics simulation of anti-thrombotic peptides and experimental validation by nanomedicine delivery

Supervisor:

Associate Professor Arnold Lining Ju, Snow Fellow GAICD FHEA – **arnold.ju@sydney.edu.au**

Research Areas:

Molecular dynamics simulation, AlphaFold, Molecular docking, Computational biology, Peptide, nanoparticle

Project Description:

Heart and vascular diseases remain a significant concern in modern medicine, with a shocking 5.6% of Australian adults over 18 facing these challenges in 2017-18. While the interplay of shear in blood flow and its effect on proteins like von Willebrand factor (VWF) and FVIII is evident, a comprehensive understanding of their structures remains elusive.

Enter the revolutionary AlphaFold, a DeepMind-developed AI software, which demonstrated unparalleled accuracy in predicting protein structures, particularly with its AlphaFold 2 version. This project aims to harness the profound capabilities of AlphaFold to dive deep into the intricate mechanisms of these proteins.

Once we decode and design our anti-thrombotic peptides, the journey doesn't stop. We will step into the exhilarating world of nanotechnology. Using cutting-edge techniques, we plan to design nanocarriers tailored for optimal drug delivery, ensuring that our drugs not only impede thrombosis but are also delivered efficiently to their intended targets without interfering with hemostasis. This integration of computational design with experimental nanotechnology offers students a chance to be at the forefront of interdisciplinary research.

Further information:

We are looking for candidates with the following skills and experience:

- Academic knowledge in the discipline of biophysics, biomechanics, electrophysiology, cell biology and biochemistry.
- Experience of Linux/Unix commanding line (Unix shell).
- Capability of using two or more of GROMACS, Hex, LabVIEW, Python, AutoCAD, MATLAB and other software.

Preferred experience includes:

- Solid basic knowledge of biology and hands-on experience in PC2 biological laboratory, using flow cytometer, ELISA, Western blots, protein-protein interaction assays, protein/antibody purification and functional characterizations.
- Experience in theoretical simulation using and MATLAB or COMSOL, or LabVIEW programming to control equipment and devices.
- Capability of independently output processing models and drawings, be capable of CNC programming, use other conventional processing platform equipment to manufacture mechanical parts, and use 3D printers for part manufacturing.
- Pre-doctoral track records with publications, conference papers, reports, professional or technical contributions with evidence of independent research ability.
- Excellent oral and written communication skills.

To learn more about the Snow-Ju Lab: Mechanobiology and Biomechanics Laboratory (MBL) and our research, please visit our official website (https://snowmedical.org.au/fellow/lining-arnold-ju/). For more information on A/Prof Ju's Snow Fellowship and groundbreaking research, check out these public release news articles:

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How to Apply:

If you are interested in this opportunity, you can complete your Expression of Interest via https://sydney.au1.qualtrics.com/jfe/form/SV_5vSA2po0sooUt0i**,** additional enquires can be emailed to **arnold.ju@sydney.edu.au** with the subject line "PhD Application" and the project title in the body of the email.

Exploring Tumor-Endothelium Mechanobiology: Development of Advanced Imaging Technologies for 3D Cancer-Induced Thrombosis

Supervisor:

Associate Professor Arnold Lining Ju, Snow Fellow GAICD FHEA – **arnold.ju@sydney.edu.au**

Research Areas:

Tumour spheroids, Microfluidics, Volumetric imaging, Super resolution microscopy, Thrombosis

Project Description:

The intricate dance between tumors and their surrounding microvasculature holds keys to many pathological mysteries. Utilizing the foundation laid by the paper, "3D spheroid-microvasculature-on-a-chip for tumor-endothelium mechanobiology interplay," this project seeks to delve deeper into these interactions by pioneering advanced imaging technologies.

Our mission is dual-faceted:

1. Develop and refine single-molecule tracking and super-resolution imaging technologies such as TIRF, HiLo, PALM, STORM, and Lattice Light-Sheet Microscopy.

2. Implement these imaging methodologies to study the dynamic processes of thrombosis and platelet activation. This includes the analysis of molecular conformational changes in entities like integrin receptors, cytoskeletons, and mechano-sensitive ion channels, as well as protein assembly, relocation, and interactions.

One of our overarching goals is to render a comprehensive "molecular interactome" detailing the nuanced interactions between platelets in both healthy individuals and cardiovascular patients grappling with conditions such as diabetes, obesity, and metabolic syndromes.

Lastly, using the high-volume 2D-3D image data generated, we'll venture into the realm of anti-platelet drug screenings, aiming to find potential therapeutics that can alter these tumor-endothelium interactions beneficially.

Further information:

We are looking for candidates with the following skills and experience:

- Skilled in using at least one optical design software such as ZEMAX, Lighttools, Codev, TRACEPRO.
- Master basic optical theory, diffractive optics, Fourier optics, photoelectric information processing and other basic theories, and understand the design principles of microscope imaging systems.
- Familiar with the design of optoelectronic system architecture. Experience in microscope and imaging optical system design and production is preferred.
- Responsible for optical system design and component selection, assembly and debugging of optical systems.
- Solid basic knowledge of biology and rich experience in the PC2 biological laboratory, applicants with related scientific backgrounds such as pathological imaging diagnosis, intracellular organ imaging mechanism analysis, bioprobe labeling, targeted therapy, etc.

Preferred experiences include:

- Optical microscopy imaging, optical super-resolution imaging, adaptive optics, and the principles of fluorescent materials.
- Use of spatial light modulators, deformable mirror devices, and acoustic optical deflectors.

To learn more about the Snow-Ju Lab: Mechanobiology and Biomechanics Laboratory (MBL) and our research, please visit our official website (https://snowmedical.org.au/fellow/lining-arnold-ju/). For more information on A/Prof Ju's Snow Fellowship and groundbreaking research, check out these public release news articles:

A father had a heart attack at 54. His son's technology could have predicted it (https://www.smh.com.au/national/nsw/a-father-had-a-heart-attack-at-56-his-son-s-technology-could-ve-predicted-it-20230327-p5cvkj.html)

How to Apply:

If you are interested in this opportunity, you can complete your Expression of Interest via https://sydney.au1.qualtrics.com/jfe/form/SV_5vSA2po0sooUt0i**,** additional enquires can be emailed to **arnold.ju@sydney.edu.au** with the subject line "PhD Application" and the project title in the body of the email.

Thin Film Coatings and Hydrogels for Cell Culture Microenvironments

Supervisor:

Professor Marcela Bilek – marcela.bilek@sydney.edu.au

Research Area:

Surface Engineering; Thin Film Deposition

Project Description:

These projects are all linked to an Australian Research Council Laureate Research Program entitled "Plasma surface engineering for break-through technologies in biomedicine". This research program focuses on development and demonstration of new technologies for biomedical applications using biologically functional surfaces and materials created by environmentally sustainable plasma processes. Projects are available in the areas of nanotechnology, microfluidics, biosensing, implantable biomedical devices, organ-on-a-chip as well as the development of novel materials and plasma processes are available. Techniques employed include computational modelling and experimental studies utilising a wide range of plasma processes and diagnostics; processing discharges; surface and materials analysis techniques; as well as cell culture and biochemical studies.

Further information:

Applicants should have good communication skills and an interest to work in multidisciplinary teams will be advantageous.

Plasma Polymerised Nanoparticles for Diagnostics and Therapeutics

Supervisor:

Professor Marcela Bilek – marcela.bilek@sydney.edu.au

Research Area:

Plasma polymerisation; Plasma processing; Biomolecule Functionalisation

Project Description:

These projects are all linked to an Australian Research Council Laureate Research Program entitled "Plasma surface engineering for break-through technologies in biomedicine". This research program focuses on development and demonstration of new technologies for biomedical applications using biologically functional surfaces and materials created by environmentally sustainable plasma processes. Projects are available in the areas of nanotechnology, microfluidics, biosensing, implantable biomedical devices, organ-on-a-chip as well as the development of novel materials and plasma processes are available. Techniques employed include computational modelling and experimental studies utilising a wide range of plasma processes and diagnostics; processing discharges; surface and materials analysis techniques; as well as cell culture and biochemical studies.

Further information:

Applicants should have good communication skills and an interest to work in multidisciplinary teams will be advantageous.

Surface Functionalisation for Microfluidic Devices

Supervisor:

Professor Marcela Bilek – marcela.bilek@sydney.edu.au

Research Area:

Functional Materials; Composite and Hybrid Materials; Surface Coatings

Project Description:

These projects are all linked to an Australian Research Council Laureate Research Program entitled "Plasma surface engineering for break-through technologies in biomedicine". This research program focuses on development and demonstration of new technologies for biomedical applications using biologically functional surfaces and materials created by environmentally sustainable plasma processes. Projects are available in the areas of nanotechnology, microfluidics, biosensing, implantable biomedical devices, organ-on-a-chip as well as the development of novel materials and plasma processes are available. Techniques employed include computational modelling and experimental studies utilising a wide range of plasma processes and diagnostics; processing discharges; surface and materials analysis techniques; as well as cell culture and biochemical studies.

Further information:

Applicants should have good communication skills and an interest to work in multidisciplinary teams will be advantageous.

Interfaces for Biosensing

Supervisor:

Professor Marcela Bilek – marcela.bilek@sydney.edu.au

Research Area:

Surface Coatings; Plasma processing; Composite and Hybrid Materials

Project Description:

These projects are all linked to an Australian Research Council Laureate Research Program entitled "Plasma surface engineering for break-through technologies in biomedicine". This research program focuses on development and demonstration of new technologies for biomedical applications using biologically functional surfaces and materials created by environmentally sustainable plasma processes. Projects are available in the areas of nanotechnology, microfluidics, biosensing, implantable biomedical devices, organ-on-a-chip as well as the development of novel materials and plasma processes are available. Techniques employed include computational modelling and experimental studies utilising a wide range of plasma processes and diagnostics; processing discharges; surface and materials analysis techniques; as well as cell culture and biochemical studies.

Further information:

Applicants should have good communication skills and an interest to work in multidisciplinary teams will be advantageous.

Scaffolds and tailored environments for tissue regeneration and disease modeling

Supervisor:

Professor Marcela Bilek – marcela.bilek@sydney.edu.au

Research Area:

Biomolecule Functionalisation; Biofabrication

Project Description:
These projects are all linked to an Australian Research Council Laureate Research Program entitled "Plasma surface engineering for break-through technologies in biomedicine". This research program focuses on development and demonstration of new technologies for biomedical applications using biologically functional surfaces and materials created by environmentally sustainable plasma processes. Projects are available in the areas of nanotechnology, microfluidics, biosensing, implantable biomedical devices, organ-on-a-chip as well as the development of novel materials and plasma processes are available. Techniques employed include computational modelling and experimental studies utilising a wide range of plasma processes and diagnostics; processing discharges; surface and materials analysis techniques; as well as cell culture and biochemical studies.

Further information:

Applicants should have good communication skills and an interest to work in multidisciplinary teams will be advantageous.

Biomolecule patterning for guided biomolecule and cell responses

Supervisor:

Marcela Bilek **–** marcela.bilek@sydney.edu.au

Research Area:

Biomolecule Functionalisation; Biofabrication

Project Description:

These projects are all linked to an Australian Research Council Laureate Research Program entitled "Plasma surface engineering for break-through technologies in biomedicine". This research program focuses on development and demonstration of new technologies for biomedical applications using biologically functional surfaces and materials created by environmentally sustainable plasma processes. Projects are available in the areas of nanotechnology, microfluidics, biosensing, implantable biomedical devices, organ-on-a-chip as well as the development of novel materials and plasma processes are available. Techniques employed include computational modelling and experimental studies utilising a wide range of plasma processes and diagnostics; processing discharges; surface and materials analysis techniques; as well as cell culture and biochemical studies.

Further information:

Applicants should have good communication skills and an interest to work in multidisciplinary teams will be advantageous.

The role of surface charge and electric fields in biomolecule interactions

Supervisor:

Professor Marcela Bilek – marcela.bilek@sydney.edu.au

Research Area:

Surface Activation; Electrical Discharges

Project Description:
These projects are all linked to an Australian Research Council Laureate Research Program entitled "Plasma surface engineering for break-through technologies in biomedicine". This research program focuses on development and demonstration of new technologies for biomedical applications using biologically functional surfaces and materials created by environmentally sustainable plasma processes. Projects are available in the areas of nanotechnology, microfluidics, biosensing, implantable biomedical devices, organ-on-a-chip as well as the development of novel materials and plasma processes are available. Techniques employed include computational modelling and experimental studies utilising a wide range of plasma processes and diagnostics; processing discharges; surface and materials analysis techniques; as well as cell culture and biochemical studies.

Further information:

Applicants should have good communication skills and an interest to work in multidisciplinary teams will be advantageous.

PhD and MPhil Opportunities in Bioelectronics

Supervisor:

Xudong Tao Research Group, School of Biomedical Engineering, The University of Sydney

Dr Xudong Tao will join the School of Biomedical Engineering at the University of Sydney as a Lecturer and Group Leader. We are seeking highly motivated PhD and Master by Research (MPhil) students to join our growing team. Our research focuses on developing multifunctional implantable bioelectronic microsystems to address major challenges in brain health.

Students will be supervised by Dr Xudong Tao and co-supervised by Professor Wei Chen, providing an interdisciplinary research environment spanning bioelectronics, advanced manufacturing, biomedical engineering, and translational medicine.

Research Areas:

1. **Bioelectronic Medicine**

Brain tumours remain one of the most challenging diseases to diagnose and treat, requiring safer, more precise, and minimally invasive therapeutic strategies. We develop implantable bioelectronic systems for brain tumour diagnosis and therapy, aiming to advance precision medicine through innovative bioelectronic technologies.

2. **Advanced Manufacturing for Flexible Bioelectronic Microsystems**

Advanced manufacturing is essential for realizing flexible bioelectronic microsystems. We develop innovative manufacturing strategies by integrating advanced microfabrication, multimaterial device integration, and scalable manufacturing technologies to enable implantable bioelectronic systems.

We Welcome Applicants with Backgrounds in:

- Biomedical Engineering
- Materials Science and Engineering
- Electronic Engineering
- Mechanical Engineering
- Micro/Nanofabrication
- Neuroscience and Related disciplines

Desirable Experience (not required):

- Flexible electronics, bioelectronics, biosensors, neural interfaces, or implantable bioelectronic devices
- Micro/nanofabrication, thin-film processing, laser processing, or 3D printing
- Microfluidics, biomaterials, drug delivery, or microsystems
- Electrochemistry, electrochemical impedance spectroscopy, or COMSOL
- Programming (e.g. Python), or biosignal analysis
- Cell culture, animal studies, or other biological research experience

What we offer:

- Cutting-edge research projects and comprehensive research training
- Hands-on experience in bioelectronic device design, advanced manufacturing, biological experiments, and microsystem integration
- Collaboration opportunities with leading international researchers and research institutions
- Support for high-impact publications and international conferences

Funding Opportunities:

Two fully funded PhD positions are available in the group. Outstanding applicants are encouraged to apply for competitive scholarships and funding opportunities, with full support provided throughout the application process.

How to Apply:

Prospective students are encouraged to contact Dr Xudong Tao **taoxudonguk@gmail.com**

Please use 'PhD/MPhil Application – Your Name – Research Interest' as the email subject line.

Application materials:

- CV
- A short statement of research interests

Join us in advancing bioelectronic medicine!

Chemical and Biomolecular Engineering Projects

Therapeutic delivery of gene editing enzymes to musculoskeletal tissues

Supervisor:

Associate Professor Aaron Schindeler – aaron.schindeler@sydney.edu.au

About the opportunity:

This project focuses on the targeted delivery of gene editing tools to musculoskeletal tissues using adeno-associated viral (AAV) vectors and nanoparticle-based delivery systems. Students will develop and characterise engineered vectors that express CRISPR nucleases, base editors, or prime editors. Therapeutic payloads will be optimised for editing efficiency, specificity, and tissue penetration. In vitro work will utilise musculoskeletal-derived cell lines and organoid cultures, with lead candidates progressing to preclinical testing in murine models of muscle or bone disease. Outcomes will include both molecular endpoints (on-target editing, off-target profiling) and functional recovery metrics assessed by imaging, biomechanics, and histology.

This project is suited to students with an interest in translational gene therapy, molecular biology, or musculoskeletal biology. It is offered as a PhD project, with the possibility of adapting it to a Masters project. Strong candidates will have a foundation in biomolecular engineering and/or molecular genetics, excellent attention to detail, and a willingness to work collaboratively in a cross-disciplinary team.

Additional information:

Co-supervisor Alexandra O'Donohue alexandra.odonohue@sydney.edu.au

For more information contact A/Prof Aaron Schindeler at aaron.schindeler@sydney.edu.au

Bioleaching of Critical Metals from E-Waste

Supervisor:

Professor Marjorie Valix – marjorie.valix@sydney.edu.au

About the opportunity:

This PhD research will delve into the innovative extraction of critical metals from waste streams using a bioleaching approach, an environmentally friendly and sustainable method. By harnessing the power of microorganisms, this study aims to revolutionise how we recover valuable metals from e-waste and batteries. The research will encompass comprehensive laboratory-based testing to optimise conditions for maximum metal recovery, alongside pilot-scale experiments that simulate real-world applications. This dual approach will not only advance our understanding of bioleaching processes but also pave the way for practical implementations in the recycling industry.

Join us in this exciting journey to contribute to the circular economy and help address the pressing challenges of electronic waste management. Your work will play a vital role in promoting sustainability and resource efficiency, making a meaningful impact on both the environment and the economy. If you're passionate about merging engineering and environmental science, this PhD opportunity is perfect for you.

Offering:

A scholarship for 3.5 years at the RTP stipend rate (currently $42,754 in 2026). International applicants will have their tuition fees covered.

Scholarship funded by Smartcrete CRC.

Successful candidates must:

Have a Bachelors degree (1st class honours or equivalent) or a Masters degree.

How to Apply:

Please send your transcript, a CV and short introduction about why you are interested in this project to marjorie.valix@sydney.edu.au.

A Risk-Based Consequence Matrix Tool for Asset Failure Assessment

Supervisor:

Professor Marjorie Valix – marjorie.valix@sydney.edu.au

Research Areas:

Asset Management, Concrete, Infrastructure

About the opportunity:

The SmartCrete Cooperative Research Centre (SmartCrete CRC) is a government-funded initiative aimed at promoting industry-led research to improve the cost efficiency, productivity, and sustainability of Australian concrete infrastructure.

Through the SmartCrete CRC, the University of Sydney and various stakeholders are developing a decision support tool designed to predict the likelihood of asset failure and critically evaluate its consequences.

This project contributes by offering a comprehensive tool to assess the potential impacts of water infrastructure asset failure, facilitating better-informed decision-making and proactive risk management within the water sector.

SmartCrete CRC is undertaking a crucial mission in the water sector. Our collective goal is to ensure that the water services of our industry collaborators remain accessible, reliable, and trustworthy, despite the challenges posed by aging infrastructure and financial constraints.

While other roles within the project focus on developing advanced deterministic models to predict potential asset failures, this role is dedicated to examining the consequences of such failures. This involves investigating the wide-ranging impacts, including financial losses, environmental damage, community disruptions, and risks to human health. A practical tool (a consequence matrix) will be developed from deterministic models to simplify these complex scenarios.

This matrix will help Australia's water utilities to assess the severity of potential outcomes, considering factors such as the number of people affected, traffic congestion, and economic losses. Through close collaboration, we aim to not only improve the functionality of water systems but also protect communities and the environment.

The role and the research will involve the following:

- Contribute to the development of the consequence matrix for the water infrastructures.
- Develop Critical Infrastructure Rating (CIR) by analysing the various factors for asset failures such as economic and environmental
- Contribute to the communication of research results through papers, seminars, and conference presentations.
- Collaborate with colleagues in organisations linked to SmartCrete CRC.

Offering:

This scholarship is offered to both international and domestic PhD applicants for 3.5 year (fulltime) at the RTP stipend rate of $42,754 p.a. (2026 rate)

Successful candidates must:

- Have a Bachelors degree (1st class honours or equivalent) or a Masters degree in chemical, environmental, or civil engineering
- Demonstrate strong computational skills
- Demonstrate ability in process/project design and modelling
- Have familiarity with techno-economic modelling, critical infrastructure rating, life cycle costing/assessment
- Have excellent oral and written communication skills
- Have the ability to work well with others in a team
- Have industry experience in civil construction for the water and/or transportation industries (desirable)
- Have industry experience working for cement and/or recycling companies (desirable)

How to Apply:

To apply, please email **marjorie.valix@sydney.edu.au** the following:

- CV
- Transcripts

Utilization of carbon materials from methane pyrolysis for water treatment applications

Supervisor:

Professor Yuan Chen – **yuan.chen@sydney.edu.au**

Research Areas:

Carbon materials, Water treatment

About the opportunity:

CH4 pyrolysis (CH4 ® 2H2 + C), in which CH4 is split into H2 and solid carbon without generating CO2, is a potential bridge technology from fossil fuels to a renewable and sustainable H2 economy. Diverse types of carbon materials, such as carbon black, graphite, carbon nanotubes, carbon fibers, and hybrids of different carbon materials, can be produced from CH4 pyrolysis, often with limited control over their structures and purity. A substantial technical gap exists in controlling carbon materials and realizing their practical applications. The resulting carbon materials contain sustainable iron residues when iron catalysts are used in CH4 pyrolysis. The project will explore unpurified carbon/iron composite materials for water treatment applications. In particular, we are interested in their roles as tri-functional adsorbents and catalysts for organic contaminant degradation. The adsorption capacity in removing different types of organic contaminants will be studied. Their roles in catalyzing hydrogen peroxide synthesis and serving as electro-Fenton catalysts to enable advanced oxidation will also be examined.

Offering:

This scholarship is offered to both international and domestic PhD applicants for 3.5 year (fulltime) at the RTP stipend rate of $42,754 p.a. (2026 rate)

Successful candidates must:

- Have a Bachelors degree (1st class honours or equivalent) or a Masters degree
- Have previous research experience in carbon materials and water treatment
- Have journal publications (preferred)

How to Apply:

To apply, please email yuan.chen@sydney.edu.au the following:

- CV
- Transcripts (can be unofficial)

Utilization of carbon materials from methane pyrolysis for battery applications

Supervisor:

Professor Yuan Chen – yuan.chen@sydney.edu.au

Research Areas:

Carbon materials, Battery

About the opportunity:

CH4 pyrolysis (CH4 ® 2H2 + C), in which CH4 is split into H2 and solid carbon without generating CO2, is a potential bridge technology from fossil fuels to a renewable and sustainable H2 economy. Diverse types of carbon materials, such as carbon black, graphite, carbon nanotubes, carbon fibres, and hybrids of different carbon materials, can be produced from CH4 pyrolysis, often with limited control over their structures and purity. A substantial technical gap exists in controlling carbon materials and realizing their practical applications. The project will explore novel synthesis methods to maintain the structure of carbon materials and new cost-effective purification methods to obtain high-purity carbon materials required for battery applications. Their applications in lithium-ion, sodium-ion, and carbon-carbon batteries will be comprehensively studied to enable further industrial scale-up and commercial adoption.

Offering:

This scholarship is offered to both international and domestic PhD applicants for 3.5 year (fulltime) at the RTP stipend rate of $42,754 p.a. (2026 rate)

Successful candidates must:

- Have a Bachelors degree (1st class honours or equivalent) or a Masters degree
- Have previous research experience in carbon materials/batteries
- Have journal publications (preferred)

How to Apply:

To apply, please email yuan.chen@sydney.edu.au the following:

- CV
- Transcripts

Tandem processes for carbon dioxide utilization

Supervisor:

Professor Yuan Chen – yuan.chen@sydney.edu.au

Research Areas:

Catalyst, Carbon Dioxide Reduction

About the opportunity:

Excessive carbon dioxide emission is a crucial challenge for humanity in this century. One potential solution is converting carbon dioxide into valuable chemicals. Professor Yuan Chen's team is developing novel catalytic processes for carbon dioxide utilization as a part of the ARC Centre of Excellence for Green Electrochemical Transformation of Carbon Dioxide (GETCO2) (https://www.getco2.org/). GETCO2 is a new research Centre funded by the Australian Research Council and seven leading Australian universities with multiple international university partners. The students in this project will be based at the University of Sydney and work closely with a team of researchers in GETCO2 to gain an improved fundamental understanding of electrocatalysts and develop innovative processes to convert carbon dioxide into valuable chemicals. In particular, tandem processes that integrate electrochemical and thermal catalytic processes will be explored.

Offering:

This scholarship is offered to both international and domestic PhD applicants for 3.5 year (fulltime) at the RTP stipend rate of $42,754 p.a. (2026 rate).

Successful candidates must:

- Have a Bachelors degree (1st class honours or equivalent) or a Masters degree
- Have previous research experience in catalysts and carbon dioxide reduction
- Have journal publications (preferred)

How to Apply:

To apply, please email yuan.chen@sydney.edu.au the following:

- CV
- Transcripts (can be unofficial)

Responsive Metal-Organic Framework Glass Composite Materials

Supervisor:

Professor Deanna D'Alessandro – deanna.dalessandro@sydney.edu.au

Research Areas:

Metal-Organic Frameworks, Composite Materials, Glasses, Spectroscopy, and Electrochemistry.

About the opportunity:

This PhD Scholarship aims to support a student undertaking a PhD within the School of Chemical and Biomolecular Engineering, Faculty of Engineering.

The focus of research is the design, synthesis and characterisation of new MOF glass materials. The successful recipient will use spectroscopic and electrochemical techniques to characterise MOF glasses. They will also determine the suitability of MOF glasses in composite materials for gas storage and energy applications.

Offering:

This scholarship is offered to both international and domestic PhD applicants for 3.5 year (fulltime) at the RTP stipend rate of $42,754 p.a. (2026 rate)

Successful candidates must:

- Have an honours degree (first class) or masters in Inorganic Chemistry or Chemical Engineering**.**
- Good proficiency in programming languages and computational skill.
- Be willing to undertake research in spectroscopy and electrochemistry, and demonstrate a willingness to undertake occasional experiments at the institutes of collaborators.
- Applicants with experience in spectroscopy or electrochemistry are highly favoured.

How to Apply:

To apply, please email deanna.dalessandro@sydney.edu.au , with the subject line "PhD Application:" and your name. Include the following:

- CV
- Transcripts (can be unofficial)
- A personal statement which demonstrates how they reach the eligibility criteria.

Classification and repurposing wastes into concrete

Supervisor:

Professor Marjorie Valix – **marjorie.valix@sydney.edu.au**

Project Description:

These scholarships will support the research into the classification of various wastes streams (e.g., mining wastes, glass, waste plastics) in terms of their suitability as replacement material for specialty concrete. In this project advanced material & analytical methods, and artificial Intelligence (AI) approaches will be employed to understand the micro and macro-mechanical behaviour of the repurposed waste concrete and the factors that influence this behaviour. This project is part of a broader study that will examine the business decisions, regulatory framework, and performance of repurposed waste concrete with various industry stakeholders.

If you are interested, email the project supervisor Professor Marjorie Valix (marjorie.valix@sydney.edu.au) with your transcripts, a CV and short introduction about why you are interested. These projects will be jointly supervised by academics from the School of Chemical and Biomolecular, Civil, Electrical and Mechanical Engineering and industry personnel.

Performance assessment of repurposed concrete in water asset pipes

Supervisor:

Professor Marjorie Valix – **marjorie.valix@sydney.edu.au**

Project Description:

This scholarship will support in-service field testing to verify the performance of pre-commercial prototypes of high performing specialty and waste repurposed concrete as civil infrastructure assets, specifically as water asset pipes. This will involve using advanced material and analytical methods and sensing to understand the durability and service life of the assets both though lab and field testing. Learnings will be used to support the development of material specification and codes of practice for use of specialty concrete and waste repurposed concrete in construction of civil infrastructure in the water industry.

If you are interested, email the project supervisor Professor Marjorie Valix (marjorie.valix@sydney.edu.au) with your transcripts, a CV and short introduction about why you are interested. These projects will be jointly supervised by academics from the School of Chemical and Biomolecular, Civil, Electrical and Mechanical Engineering and industry personnel.

Servicing-Life Or Performance Models For Water Assets

Supervisor:

Professor Marjorie Valix – **marjorie.valix@sydney.edu.au**

Project Description:

These scholarships will support the research into the development of evidence-based service life models of wastewater and water assets and performance models of corrosion controls. The project will be based on evidence data modelled by physical and chemical approaches, AI, and data analytics. This project will be used to support medium and large water utilities in creating a decision platform that offers a systematic process, based on informed decisions, for operating, upgrading, and rehabilitating their physical water assets that balances risk, cost, and benefits.

If you are interested, email the project supervisor Professor Marjorie Valix (**marjorie.valix@sydney.edu.au**) with your transcripts, a CV and short introduction about why you are interested. These projects will be jointly supervised by academics from the School of Chemical and Biomolecular, Civil, Electrical and Mechanical Engineering and industry personnel.

Sensing Water Asset Conditions

Supervisor:

Professor Marjorie Valix – **marjorie.valix@sydney.edu.au**

Project Description:

This scholarship will support the research into the development of monitoring protocols and safe and reliable methods to non-destructively inspect/monitor and provide qualitative & quantitative assessment of asset health. This project will involve the development of condition assessment prototypes based on telemetry and communications systems that mimic current condition assessment protocols and decision making for water assets that rely on existing codes of defect. The proposed sensing approach will employ environmental sensing, asset sensing, artificial Intelligence (AI) and communications using advanced cellular networks.

If you are interested, email the project supervisor Professor Marjorie Valix (marjorie.valix@sydney.edu.au) with your transcripts, a CV and short introduction about why you are interested. These projects will be jointly supervised by academics from the School of Chemical and Biomolecular, Civil, Electrical and Mechanical Engineering and industry personnel.

Fundamental Mechanism of Protein Phase Behaviour

Supervisor:

Dr Yi Shen – **yi.shen@sydney.edu.au**

Research Area:

Protein liquid-liquid phase separation; Microfluidics; Biomaterials

Project Description:

The key focus of this project will be on understanding the mechanisms behind protein phase behaviour through physical parameters (e.g. temperature, size and interface), and identifying the methods to prevent the pathological transition.

Further information:

Planned start date: October 2021. Email your CV, transcript and research interests.

Biomaterials from Protein/Peptides Manipulation

Supervisor:

Dr Yi Shen – **yi.shen@sydney.edu.au**

Research Area:

Protein Liquid-Liquid Phase Separation; Microfluidics; Biomaterials

Project Description:

Development of biomaterials for microplastic replacement by taking advantage of protein phase behaviour.

Further information:

Email your CV, transcript and research interests to **yi.shen@sydney.edu.au**

Chemical Recycling of Mixed Waste Plastics

Supervisor:

Professor Ali Abbas – **ali.abbas@sydney.edu.au**

Research Area:

Chemical Engineering; Computational Fluid Dynamics; Heterogeneous Chemical Kinetics

Project Description:

Waste plastic is a growing problem in Australia and elsewhere in the world. Many plastics are uneconomic to process using conventional physical recycling technologies.

Recent advances have already demonstrated that thermochemical approaches can convert waste contaminated plastic into a feedstock for remanufacturing plastic.

The Scale-up, Optimisation and Modelling of Chemical Recycling of Mixed Waste Plastics Postgraduate Research Scholarship has been established to provide financial assistance to PhD students who are undertaking research in using advanced engineering reactors to become the next generation of processing technology that specifically targets the conversion of mixed and contaminated (non-recyclable), post-consumer waste plastic into feedstock materials for the virgin plastics manufacturing industry.

Further information:

Suitable for students with a background in Engineering or Science

Civil Engineering Projects

Microplastic mobility and retention in soil and groundwater

Supervisor:

Professor Abbas El-Zein – abbas.elzein@sydney.edu.au

About the opportunity:

The project investigates the mobility and retention of small microplastic particles (<5mm) in the vadose zone of soils (topsoils), through a set of experimental, numerical and theoretical developments. The project is a collaboration between USyd's School of Civil Engineering and the School of Life and Environmental Sciences (SOLES), and between the University of Sydney and Imperial College, London.

Microplastics are emerging contaminants that have been detected in the human body as well as a wide range of ecosystems, including soils. Evidence is mounting of their negative health and ecological impacts. The goal of this project is to improve our understanding of the ability of soils to filter through microplastics and prevent their migration into the hydrosphere. The successful applicant will conduct microfluidics experiments to investigate the interaction between microplastic particles and water/air/solid phases. He or she will develop pore-network models, based on computational fluid dynamics and discrete element method, to predict microplastic transport at the pore scale. Prior expertise in microfluidics is not required for this position, however, applicants with such expertise are especially encouraged to apply.

Offering:

A scholarship for 3.5 years at the RTP stipend rate (currently $42,754 in 2026). International applicants will have their tuition fees covered by the University.

Successful candidates must:

- Have a Bachelors degree (1st class honours or equivalent) or a Masters degree
- Have Excellent written and verbal communication skills in English
- Have previous research experience (desirable)

How to apply:

To apply, please email abbas.elzein@sydney.edu.au with a subject header of "PhD Microplastics-Soil Project 2026" and include the following:

- CV showing qualifications and any past research experience (Including a small section of past research experience as part of undergraduate or postgraduate studies, as well as details of any publications).
- Academic transcripts
- Applicants from non-English speaking backgrounds, much also provide information about English proficiency including a summary of scores from English proficiency exams.

Reliability Analysis of Fibre Reinforced Concrete Structures

Supervisor:

Dr Ali Amin – **ali.amin@sydney.edu.au**

Research Areas:

Fibre Reinforced Concrete, Concrete Structures

About the opportunity:

Fibre reinforced concrete is characterised by its post cracking strength. Determining these properties can be subject to a high degree of scatter which may otherwise lead to low characteristic values which may be adopted in design. Reliability analyses together with sensitivity analyses (through the use of Monte Carlo simulations) on key parameters such as variability of the material's direct tensile strength and model errors from published analytical, are required to determine reliability indices β, resistance factors ϕ and partial safety factors used in the design of fibre reinforced concrete structures.

Offering:

A scholarship for 3.5 years at the RTP stipend rate (currently $42,754 in 2026). International applicants will have their tuition fees covered.

How to apply:

To apply, please email **ali.amin@sydney.edu.au** the following:

- CV
- academic transcripts

Understanding fate of pathogenic viruses in sewers to advance wastewater surveillance

Supervisor:

Dr Jiaying Li – **jiaying.li@sydney.edu.au**

Research Areas:

Infectious diseases, genomic sequencing, wastewater-based epidemiology, environmental monitoring

About the opportunity:

This project covers several topics and areas:

- Applying molecular diagnostics and genomic sequencing techniques to detect and quantify various pathogenic viruses and their variants in real sewers;
- Determining the fate of viruses in dynamic sewer environments;

- Developing a fate model for pathogenic viruses within urban sewer systems to advance wastewater-based epidemiology for infectious diseases.

Offering:

A scholarship for 3.5 years at the RTP stipend rate (currently $42,754 in 2026). International applicants will have their tuition fees covered.

Successful candidates must:

- Have a Bachelors degree (1st class honours or equivalent) or a Masters degree
- Have research experience in research experience in Microbiology, Environmental Microbiology, Environmental Science, Environmental Engineering, Molecular Biology, Biology and Medicine, Biotechnology, Public Health, and relevant disciplines.

How to apply:

To apply, please email please email **jiaying.li@sydney.edu.au** the following:

- CV showing qualifications and past research experience or publications
- academic transcripts

Fate of contaminants of emerging concern in urban wastewater systems

Supervisor:

Dr Jiaying Li – **jiaying.li@sydney.edu.au**

Research Areas:

Emerging Contaminants, Wastewater Treatment, Environmental Protection

About the opportunity:

This project focuses on understanding the fate of contaminants of emerging concern (CECs) within integrated urban water and wastewater systems. This encompasses studying the transport, transformation, and removal of substances like pharmaceutical and personal care products (PPCPs), pesticides, PFAS, and industry chemicals across sewer systems, wastewater treatment plants, and receiving environments. Research in this area is crucial for understanding the environmental impact of these contaminants and improving treatment technologies. This work requires both in-depth knowledge and hands-on experience in sewer engineering, wastewater biological treatment, and advanced treatment technologies.

This project covers several topics and areas:

Source Tracking and Management: Developing methods for source identification and control of contaminants in sewage systems, including from industry and domestic inputs.

Emerging Contaminant Removal: Developing approaches and techniques to separate, remove, and destroy contaminants of emerging concerns from wastewater, recycling water, drinking water, and biosolids.

Biosensors in Wastewater: Innovating biosensor technology for in-situ monitoring of contaminants and pathogens in wastewater environments.

Offering:

A scholarship for 3.5 years at the RTP stipend rate (currently $42,754 in 2026). International applicants will have their tuition fees covered.

Successful candidates must:

- Have a Bachelors degree (1st class honours or equivalent) or a Masters degree
- Have research experience in Environmental Science, Environmental Engineering, Chemistry, Organic Chemistry, Control Science and Engineering, Automation, Biotechnology, and relevant disciplines.

How to apply:

To apply, please email please email jiaying.li@sydney.edu.au the following:

- CV showing qualifications and past research experience or publications
- academic transcripts

An innovative approach for understanding public health and wellbeing through wastewater surveillance

Supervisor:

Dr Jiaying Li – jiaying.li@sydney.edu.au

Research Areas:

Wastewater epidemiology, Disease surveillance, Genomic sequencing

About the opportunity:

To date, there is an urgent need for local and global burden of disease analysis because the community in modern society is facing increasing risks of chemical exposure, mental health, illness and diseases. Comprehensive assessments of community health status through traditional epidemiological studies and surveys have been insufficient. Wastewater-based epidemiology (WBE) has emerged as a promising approach that extends beyond drug and pharmaceutical monitoring, encompassing human health, well-being, and disease tracking, which has been particularly evident during the COVID-19 pandemic. The practical application for a broader spectrum of human health biomarkers is still in its early stages, necessitating further research to fully exploit the values and insights minded from wastewater resources. This project aims to develop a multi-disciplinary approach for understanding public health and wellbeing through wastewater surveillance.

This project involves at both chemical and biological sectors.

1. Public Health Insights through Wastewater-Based Epidemiology

This research is dedicated to advancing public health and wellbeing understanding through innovative wastewater-based epidemiology. By analysing a wide range of health-related biomarkers—from medications and illicit drugs to diet and metabolism indicators—this work captures real-time, population-level insights into disease burdens and chemical exposures. This involves the use of sophisticated instruments such as LC-MS/MS, alongside smart sampling technologies, to provide a comprehensive view of community health dynamics integrating socioeconomic data.

2. Viral pathogens and Diseases Surveillance in Wastewater.

Building on the success of wastewater surveillance during the COVID-19 pandemic, this research aims to refine these methods to detect and predict outbreaks of pathogenic viruses with epidemic and pandemic potential. This involves collecting and analysing wastewater samples from varied sources, from community

to catchment levels, using advanced genomic sequencing (qPCR, RT-qPCR, metagenomics) and intelligent modelling techniques, thereby enhancing the early warning capabilities of wastewater systems for community safeguarding.

Offering:

A scholarship for 3.5 years at the RTP stipend rate (currently $42,754 in 2026). International applicants will have their tuition fees covered.

Successful candidates must:

- Have a Bachelors degree (1st class honours or equivalent) or a Masters degree
- Have research experience in Environmental Science, Environmental Engineering, Chemistry, Microbiology, Molecular Biology, Biology and Medicine, Public Health, and relevant disciplines.

How to apply:

To apply, please email please email **jiaying.li@sydney.edu.au** the following:

- CV showing qualifications and past research experience or publications
- academic transcripts

A multiscale and multiphysics model for in-situ recovery of copper

Supervisor:

Professor Luming Shen – **luming.shen@sydney.edu.au**

Research Areas:

in-situ recovery, multiscale modelling, multiphysics modelling

About the opportunity:

This project aims to develop a multiscale and multiphysics model for investigating multiphase and hydro-chemical interactions in the in-situ recovery of copper at both nanoscales and microscales.

In-situ recovery (ISR) can be a promising low-cost solution for extracting low-grade critical minerals or metals, such as copper, from ore deposits without traditional mining methods and a viable approach for decarbonising mining and processing. ISR injects the lixiviant into ore deposits to dissolve a target mineral and recover it from the production well. ISR is a low entry mining method, which has lower environmental impacts, consumes less energy for rock comminution and handling, and provides a safer working environment than traditional mining methods. However, due to the complex solid-fluid interactions and coupled hydro-chemical reactions involved, more studies need to be carried out to understand the fundamental mechanisms for optimising recovery efficiency under in-situ conditions. This project aims to develop a multiscale numerical model to study multiphase interactions and hydro-chemical interactions for the ISR of copper at both nanoscales and microscales. Molecular dynamics (MD) will be used to study the thermodynamic and kinetic properties of the multiphase system. Then, the MD results will be applied to a pore-scale model that couples the reactive flow, diffusion, and mineral deformation. The proposed multiscale and multiphysics model will be used to study the in-situ leaching process systemically to gain new knowledge for optimising the recovery efficiency and better control of the leaching solution.

Offering:

A top up stipend of $10,000 per annum provided by CSIRO.

Successful candidates must:

- Be enrolled at the University of Sydney
- Hold an appropriate visa to study in Australia (if international)
- Be no further than one year (FTE) into a PhD candidature on commencing at CSIRO
- Hold a primary scholarship; for example, a Research Training Program (RTP) scholarship or other primary scholarship of similar value
- Not be in receipt of any other top-up scholarship

How to apply:

To apply, please email please email **luming.shen@sydney.edu.au** the following:

- CV
- academic transcripts

Reliability Analysis of Fibre Reinforced Concrete Structures

Supervisor:

Dr Ali Amin – **ali.amin@sydney.edu.au**

Research Areas:

Fibre Reinforced Concrete, Concrete Structures

About the opportunity:

This study is intended to investigate estimate the reliability indices β, resistance factors ϕ and partial safety factors used in the design of fibre reinforced concrete structures.

Fibre reinforced concrete is characterised by its post cracking strength. Determining these properties can be subject to a high degree of scatter which may otherwise lead to low characteristic values which may be adopted in design. Reliability analyses together with sensitivity analyses (through the use of Monte Carlo simulations) on key parameters such as variability of the material's direct tensile strength and model errors from published analytical, are required to determine reliability indices β, resistance factors ϕ and partial safety factors used in the design of fibre reinforced concrete structures.

Offering:

This scholarship is offered to both international and domestic PhD applicants for 3.5 year (fulltime) at the RTP stipend rate of $41,753 p.a. The cost of tuition will also be provided to international students as part of the scholarship.

Successful candidates must have:

- Bachelor degree (Honours or Honours Class 1 equivalent) or a Master degree.

How to Apply:

To apply, please email **ali.amin@sydney.edu.au** the following:

- CV
- Transcripts (can be unofficial)

Biogeochemical modelling of soil organic and inorganic carbon

Supervisor:

Associate Professor Federico Maggi – federico.maggi@sydney.edu.au

Research Areas:

Environmental engineering, Soil carbon modelling, Net zero land management.

About the opportunity:

We are looking for highly qualified and motivated students to join our environmental engineering research group in the School of Civil Engineering at the University of Sydney for a full-time research project leading to a PhD degree. The project is a collaboration with the Sydney Institute of Agriculture (SIA).
The project is broadly covering the biogeochemistry of soil carbon, but emphasizes the interactions between the organic and inorganic components under environmental constraints. The aim of the project is to develop and use computational tools to model organic and inorganic soil carbon compounds, water and heat flow, and understand the mechanisms of their interactions. The project may cover various cross-disciplinary topics, including environmental engineering, agricultural sciences, hydrological processes, and land and soil management. The project can have wide applications including in soil carbon dynamics, nutrient cycles, soil physics, biogeochemistry, sustainability, and climate change.

Offering:

This scholarship is offered to both international and domestic PhD applicants for 3.5 year (fulltime) at the RTP stipend rate of $42,754 p.a. (2026 rate)

Successful candidates must have:

- A bachelor's degree (Honours or Honours Class 1 equivalent) or a Master degree.
- Good proficiency in programming languages and computational skill.

Candidates with the following skills will be considered favorably:

- Background in theoretical or computational biogeochemistry, eco/hydrology, or soil physics, and
- Be willing to learn mathematical concepts needed to develop advanced computational tools including biology, chemistry, and chemical kinetics.
- Be willing to undertake occasional high workload to meet milestones and project deadline commitments.

How to Apply:

To apply, please email federico.maggi@sydney.edu.au, with the subject line "SOC 2023" and your name. Include the following:

- 1 page expression of interest cover letter (the document is to be named as: YOURFIRSTNAME_YOURFAMILYNAME_SOC_2023.pdf)
- CV and transcripts (can be unofficial)

Material characterisation and residual stresses of 3D-printed steel structures

Supervisor:

Professor Anna Paradowska – anna.paradowska@sydney.edu.au

Research Area:

3D printed structures; steel structures; material characterisation

Project Description:

Successful 3D-printing of steel structures requires optimisation of the printing process which in this project consists of wire-arc additive manufacturing (WAAM). The project will investigate the influence of weld track spacing and overlapping, scanning sequence, heat input, wire feed rate and pause time between track depositions. Test specimens will be 3D-printed for selected combinations of process parameters, and weld residual stresses will be measured in-situ on the neutron strain scanner at ANSTO, allowing the residual stress evolution to be investigated. The development of the residual stresses will be then modelled using finite element (macroscale) simulations that predict the overall residual stress field and distortion of WAAM-printed components. After verifying the accuracy of the numerical predictions against experimental results, the models will be used to uncover the interdependency between the weld process variables, including voltage, amps, speed, patterning, dwell time and interpass temperature, and the mechanical properties and residual stress fields, thereby enabling the rapid optimisation of WAAM-process variables.

Further, to understand the microstructure of WAAM-printed materials, optical, Scanning Electron Microscopy (SEM) and Electron Back-Scatter Diffraction (EBSD) procedures will be used for identification of microstructure, and neutron radiography and imaging will be used to study the efficiency of the printing process and the formation of volumetric defects such as porosity and inclusions. Based on these observations, a parameter set that minimises defects and optimises for residual stress, required microstructure and strength will be identified. The project will provide the successful candidate with cutting-edge and industry sought-after knowledge about the material characterisation of 3D-printed steel structures. It is part of a larger project supported by the Australian Research Council which comprises multiple PhD projects including research on the crystal plasticity mechanisms that control microstructure and mechanical properties, and the macroscopic testing and analysis of structural connections.

Further information:

The scholarship is available to domestic and international students. The start date is flexible.

Computer Science Projects

Deep Learning for Automatic Game Character Designs

Supervisor:

Associate Professor Chang Xu – chang.xu@sydney.edu.au

Research Areas:

Deep Learning, Computer Vision

About the opportunity:

The proposed research project aims to develop advanced personalized diffusion models that enable users to generate, edit, and interact with 3D character assets using intuitive text prompts and image uploads. By optimizing the diffusion process and integrating sophisticated natural language processing and computer

vision techniques, the project will translate user inputs into high-quality 3D characters. An intuitive user interface will facilitate real-time adjustments, while comprehensive user studies and performance metrics will guide iterative improvements. This technology promises to enhance creative workflows in gaming, animation, and virtual reality, making 3D character generation more accessible and personalized.

This project will employ advanced mathematical modeling to optimize the diffusion process for 3D character generation. It will utilize state-of-the-art NLP techniques to interpret text prompts and cutting-edge computer vision methods to analyze image uploads. The development of an intuitive user interface will enable real-time interaction and refinement. Comprehensive user studies and defined performance metrics will be conducted to evaluate effectiveness and guide improvements.

Offering:

A scholarship for 3.5 years at the RTP stipend rate (currently $42,754 in 2026). International applicants will have their tuition fees covered.

The scholarship is funded by Arit Games.

Successful candidates must:

- Have a Bachelors degree (1st class honours or equivalent) or a Masters degree
- Proficiency in programming languages like Python and experience with deep learning frameworks (e.g., TensorFlow, PyTorch) and NLP tools.
- Prior research experience in machine learning, computer vision, and NLP is highly desirable.
- Strong analytical skills and excellent communication abilities.
- A passion for AI-driven technologies in creative industries is essential.

Additionally, candidates are expected to have a publication record in relevant venues.

How to Apply:

To apply, please email **c.xu@sydney.edu.au** the following:

- CV
- Transcripts

Cryptography for Modern Applications

Supervisor:

Dr Aravind Thyagarajan – **aravind.thyagarajan@sydney.edu.au**

Research Areas:

Cryptography, Blockchain, Game Theory

About the opportunity:

The primary research focus is designing distributed applications, where a set of mutually distrustful users interact and compute a function over their private inputs without any centralized trust. Such scenarios are abundant in the digital world, like cloud computing, privacy-preserving computation, and blockchains, to name a few.

The goal is to use techniques from cryptography, and game theory to achieve the elusive properties of security, privacy, fairness, and efficiency, for users in such applications. Security and privacy ensures an attacker cannot learn unintended information from an honest user. For fairness, we seek (a) cryptographic

fairness, which assures users of receiving their output if the attacker receives his, and (b) game-theoretic fairness, where a rational adversary has no incentive to harm honest users.

The overarching theme of the project is to construct practical solutions based on well-studied mathematical structures directly impacting real-life systems and lay solid theoretical foundations emphasizing formal models and analysis.

Given the emphasis on strong theoretical foundations and formal treatment, the primary technique is to design sound mathematical definitions for security and fairness.

Followed by building algorithms and using cryptographic reduction technique (similar to reductions used in complexity theory) to prove that the algorithm is secure according the definition. The project would often involve developing a proof of concept of the crypto system being built and additional benchmarking wherever needed.

Offering:

A scholarship for 3.5 years at the RTP stipend rate (currently $42,754 in 2026). International applicants will have their tuition fees covered.

Successful candidates must:

- Have a Bachelors degree (1st class honours or equivalent) or a Masters degree
- Have good understanding of probability theory, and algorithms
- Have a background in complexity theory, and mathematics especially topics like number theory, and abstract algebra are valued
- Have experience with programming is a bonus

How to Apply:

To apply, please email **aravind.thyagarajan@sydney.edu.au**, with the subject line “PhD Application:” and your name. Include the following:

- CV
- Transcripts

System ML, IoT/edge Driven ML Adaptation

Supervisor:

Associate Professor Shuaiwen Song – **shuaiwen.song@sydney.edu.au**

Research Area:

Machine Learning; Internet of Things; Neural Networks & Architecture

Project Description:

The topics include but are not limited to: Machine learning model deployment, large-scale system optimisation, software-hardware co-designing for training and inference, recommendation models and their deployment, emerging neural networks and models exploration and deployment, neural architecture search, real time optimisation on power and performance efficiency, tiny ML, compiler-hardware co-design, system design and prototyping, symbolic AI + compilation optimisation on small devices.

Logic-based planning under ignorance

Supervisor:

Sasha Rubin - sasha.rubin@sydney.edu.au

Project Description:

The aim of this work is to develop mathematical foundations, algorithms, and prototype implementations for constructing agents that make decisions under ignorance.

Applicants are expected to have a strong background in discrete mathematics, algorithms, or related topics, and an undergraduate and/or master's degree in Computer Science, Mathematics, or related disciplines.

Funding:

One PhD Student for 3.5-year full scholarship is available at the current 2026 RTP rate.

How to apply:

Email sasha.rubin@sydney.edu.au and academic transcript and any relevant research outputs.

Electrical and Computer Engineering Projects

Reflective intelligent surface (RIS) / Reflective holographic surface (RHS) / THz for 6G communications

Supervisor:

Dr Zihuai Lin – zihuai.lin@sydney.edu.au

Project Description:

This project explores the design and integration of Reflective Intelligent Surfaces (RIS), Reflective Holographic Surfaces (RHS), and Terahertz (THz) technologies to enable high-capacity, energy-efficient, and ultra-reliable wireless communication, addressing key challenges for 6G networks. It offers opportunities to advance next-generation communication paradigms by optimising spectrum use, coverage, and connectivity.

With the explosive growth of wireless networks and the Internet, network resource utilisation becomes one of the critical design issues. This research investigates the potential of Reflective Intelligent Surfaces (RIS), Reflective Holographic Surfaces (RHS), and Terahertz (THz) technologies as enabling solutions for 6G wireless communications. RIS and RHS provide programmable, low-power, and cost-effective approaches to reshape wireless propagation environments by intelligently controlling electromagnetic waves, while THz frequencies offer vast bandwidths to support ultra-high data rates and low-latency applications. The project aims to develop novel system models, signal processing, and optimization algorithms to address challenges in channel estimation, beamforming, and interference management. By integrating RIS/RHS with THz communications, the research seeks to enhance coverage, spectral efficiency, and energy efficiency, paving the way for transformative 6G use cases such as holographic communications, extended reality, and ultra-reliable low-latency services.

Research Techniques / Methodologies / Technologies

The project will combine theoretical modelling, algorithm development, and experimental validation. Research techniques include signal processing, coding and modulation design, optimisation, and machine learning methods for reliable backscatter detection. Tools such as MATLAB, Python, and hardware testbeds with software-defined radios (SDR) may be employed to simulate and prototype ambient backscatter systems in real-world IoT scenarios.

Offering:

A scholarship for 3.5 years at the RTP stipend rate (currently $42,754 in 2026). International applicants will have their tuition fees covered.

Successful candidates:

- must have a strong background in wireless communications, digital signal processing, and applied mathematics.
- must have experience with IoT systems, RF hardware, or machine learning for communications is desirable.
- should have proficiency in programming languages such as MATLAB, Python, or C/C++, along with an interest in next-generation IoT technologies and energy-efficient communications,

How to apply:

If you are interested in this opportunity email **zihuai.lin@sydney.edu.au** the following:

- a detailed CV, including academic qualifications, research experience and publications
- academic transcripts

Ambient backscatter communications for IoT

Supervisor:

Dr Zihuai Lin – **zihuai.lin@sydney.edu.au**

Project Description:

This project investigates ambient backscatter communications as a low-power and cost-effective solution for the Internet of Things (IoT), enabling battery-free devices to communicate by harvesting and reflecting existing radio signals. It offers opportunities to develop innovative system designs and protocols that enhance connectivity, energy efficiency, and scalability for massive IoT deployments.

This research focuses on ambient backscatter communications (AmBC) as a promising paradigm for sustainable Internet of Things (IoT) connectivity. Unlike conventional radios, AmBC devices do not generate their own carrier signals but instead harvest and modulate existing RF signals (e.g., WiFi, TV, or cellular transmissions), enabling ultra-low-power and battery-free communications. The project aims to investigate system models, modulation and coding schemes, and interference management strategies to overcome challenges such as low data rates, limited range, and co-channel interference. Advanced techniques such as machine learning-assisted signal detection, multiple access design, and cooperative networking will be explored to enhance the reliability and scalability of AmBC systems. By addressing these challenges, the research will contribute to the development of energy-efficient, cost-effective, and sustainable IoT networks, supporting applications in smart cities, healthcare, and industrial automation.

Research Techniques / Methodologies / Technologies

The project will employ a combination of analytical modelling, simulation, and experimental validation. Key techniques include advanced signal processing, optimisation, and machine learning methods for RIS/RHS-assisted THz communications. State-of-the-art electromagnetic simulation tools, hardware prototyping, and testbed experiments may also be utilised to validate theoretical findings.

Offering:

A scholarship for 3.5 years at the RTP stipend rate (currently $42,754 in 2026). International applicants will have their tuition fees covered.

Successful candidates:

- must have a strong background in wireless communications, signal processing, and applied mathematics,
- must experience in areas such as optimisation, machine learning, or electromagnetic modelling.
- should have proficiency in n MATLAB, Python, or related simulation tools.

Candidates with an interest in next-generation communication systems (6G), reconfigurable surfaces, and THz technologies are especially encouraged to apply.

How to apply:

If you are interested in this opportunity email **zihuai.lin@sydney.edu.au** the following:

- a detailed CV, including academic qualifications, research experience and publications
- academic transcripts

Novel Sensors for Health, Energy, and Environment

Supervisor:

Professor Xiaoke Yi – **xiaoke.yi@sydney.edu.au**

Project Description:

Harness microwave photonics and machine learning to develop ultra-sensitive sensors for healthcare, renewable energy and environmental applications.

This project will advance novel sensors by integrating the speed, bandwidth, and precision of optics with the versatility of microwave engineering and the adaptive power of machine/deep learning. It will deliver a new generation of compact, intelligent, and scalable sensors for transformative applications across renewable energy, healthcare, and environmental monitoring, addressing urgent global challenges with unprecedented performance.

Successful candidates must:

- Have an Honours degree (First Class or First Class Honours Equivalent) or a Master's degree with a substantial research component

How to apply:

If you are interested in this opportunity email **xiaoke.yi@sydney.edu.au** the following:

- CV
- Academic transcripts
- A short description of why you are interested

Photonic Signal Processors for Advanced Microwave and RF Communications

Supervisor:

Associate Professor Liwei Li – liwei.li@sydney.edu.au

Project Description:

This project investigates integrated microwave photonic processors for broadband, high-frequency, and real-time RF/optical communications.

Microwave photonic processors provide a powerful alternative to conventional electronic systems for high-speed, broadband applications such as radar, satellite communications, and emerging 6G networks. This project investigates the use of photonic delay lines, filters, and modulators to process RF and microwave signals with exceptional fidelity and wide tunability. Students will design integrated photonic components, explore hybrid optical–RF interfaces, and develop system-level architectures aimed at overcoming the fundamental bandwidth and scalability constraints of digital electronic processors.

Successful candidates must:

- Have an Honours degree (First Class or First Class Honours Equivalent) or a Master's degree with a substantial research component
- a background in electrical engineering, optics and photonics, or telecommunications

How to apply:

If you are interested in this opportunity email liwei.li@sydney.edu.au the following:

- CV
- Academic transcripts
- A short description of why you are interested

Next-Generation Multi-Parameter Nano-Photonic Sensors

Supervisor:

Associate Professor Liwei Li – liwei.li@sydney.edu.au

Project Description:

By leveraging high-index contrast silicon photonic platforms, this research explores advanced waveguide geometries and resonant structures to enhance light–matter interaction. Students will design and optimise sensor layouts, focusing on sensitivity, resolution, and noise immunity. The outcomes have broad potential, ranging from early-stage disease diagnostics and environmental monitoring to chemical composition analysis and other emerging applications, offering significant benefits for both society and industry.

Successful candidates must:

- Have an Honours degree (First Class or First Class Honours Equivalent) or a Master's degree with a substantial research component
- a background in photonics, optics, electrical engineering, or physics

How to apply:

If you are interested in this opportunity email liwei.li@sydney.edu.au the following:

- CV
- Academic transcripts
- A short description of why you are interested

Data Bias and Model Fairness in Unsupervised Machine Learning

Supervisor:

Dr Shahadat Uddin – shahadat.uddin@sydney.edu.au

Research Areas:

Fair AI; Data Bias; Unsupervised Machine Learning

Project Description:

This project investigates the impact of data bias on the fairness and reliability of unsupervised machine learning algorithms. While fairness has been extensively studied in supervised contexts, unsupervised models, such as clustering and dimensionality reduction, remain vulnerable to latent biases in input data that can propagate through analyses and decision-making pipelines. The research aims to develop theoretical frameworks and practical methodologies for detecting, quantifying, and mitigating bias in unsupervised learning, focusing on promoting equitable outcomes across diverse applications, including healthcare, education, and social data analytics.

Successful candidates must:

- Have strong background in Data Analysis, Machine Learning and Python (or similar)

How to apply:

To apply, please email shahadat.uddin@sydney.edu.au the following:

- CV
- Academic transcripts

Radio Frequency Machine Learning

Supervisor:

Professor Philip Leong – philip.leong@sydney.edu.au

Research Areas:

Radio frequency; Machine learning; FPGA

Project Description:

The aims of this research is to develop new FPGA-based systems that can localise, classify, detect, segment, and interpret radio signals with improved speed and accuracy using domain-specific architectures, with an ultimate goal of achieving RF scene understanding in the same way computer vision systems can understand video scenes.

Recent advances in machine learning have enabled computers to process and understand video scenes with excellent speed and accuracy. However, our ability to interpret radio frequency (RF) signals is not as mature, and many challenges in RF scene understanding remain unsolved research problems.

Field programmable gate arrays (FPGAs) are an ideal platform for implementing RF machine learning (RFML) systems as they can integrate a software-defined radio (SDR), digital signal processing (DSP) operations, and machine learning on a single chip, leading to improvements in latency, energy consumption and bandwidth as massively parallel on-chip computing and interconnect resources can be utilised.

Unfortunately, radio frequency machine learning (RFML) systems are not as mature as computer vision systems. In particular, some fundamental problems to be solved include: finding good feature representations, achieving good generalisation in real-world settings, and devising high-speed FPGA implementations.

Offering:

The successful candidate will be awarded a scholarship for 3.5 years at the RTP stipend rate (currently $42,754 in 2026) subject to satisfactory academic performance. International applicants will have their tuition fees covered.

Successful candidates must:

- Have a Bachelors degree (1st class honours or equivalent) or a Masters degree with a substantial research component.
- Have an interest in Cyclostationary signal processing, Low-precision neural network implementations or Synthetic data generations are strongly encouraged to apply.

How to apply:

To apply, please email **philip.leong@sydney.edu.au** the following:

- CV
- Transcript and
- Brief explanation on what motivates you to work on this project and why you would be a good choice for this topic

Edge-based Training of Deep Neural Networks using FPGAs

Supervisor:

Professor Philip Leong – **philip.leong@sydney.edu.au**

Research Areas:

Machine learning; Quantisation, FPGA

Project Description:

This research will involve FPGA implementations of training algorithms that can be utilised at the edge. The aims are to gain better insights into how low-precision arithmetic can be used to optimise FPGA-based accelerators without sacrificing accuracy and developing novel computer architectures that achieve high performance while supporting the latest machine learning techniques.

Much of the focus of FPGA-based deep neural network research has been on inference. Training on edge-devices is even more challenging because the computation and memory requirements are at least 3x higher, and many of the techniques used to optimise inference cannot be applied to training.

In this research we will explore novel computer arithmetic schemes and devise new algorithms for dealing with low-precision neural networks. Training at the edge will enable a new range of applications that allow the network to adapt to changing conditions, reduce communications bandwidth and ensure privacy.

Offering:

The successful candidate will be awarded a scholarship for 3.5 years at the RTP stipend rate (currently $42,754 in 2026) subject to satisfactory academic performance. International applicants will have their tuition fees covered.

Successful candidates must:

- Have a Bachelors degree (1st class honours or equivalent) or a Masters degree with a substantial research component.

How to apply:

To apply, please email **philip.leong@sydney.edu.au** the following:

- CV
- Transcript and
- Brief explanation on what motivates you to work on this project and why you would be a good choice for this topic

Prompt Engineering to Improve Fairness in Large Language Models

Supervisor:

Dr Shahadat Uddin – **shahadat.uddin@sydney.edu.au**

Project Description:

This research project aims to explore and develop prompt engineering techniques to improve fairness (i.e., mitigate biases) in large language models.

Although the world is witnessing an unprecedented application of Large Language Model (LLM)- based generative AI systems across various domains, these systems often produce biased or unfair outcomes. Adequate and appropriate prompt engineering is crucial for improving fairness or reducing biases in LLMs. Such a practical approach to LLMs involves understanding the nuances of language and context to create prompts that encourage more equitable responses across different demographic groups. By carefully designing and refining the input prompts used to guide these models, it is possible to mitigate biased outputs that often reflect societal prejudices. This project aims to develop prompt engineering techniques to improve fairness (i.e., reduce biases) in large language models.

Successful candidates must:

- Have a Bachelors degree (1st class honours or equivalent) or a Masters degree
- Have experience in AI, Large Language Model and Generative AI and
- Strong background in data analytics and Python (or similar)

How to apply:

To apply, please email **shahadat.uddin@sydney.edu.au**

the following:

- CV

- Transcript and
- A brief cover letter

Nanoparticle Engineering for Self-Cooling Paints and Coatings

Supervisor:

Dr Sid Assawaworrarit - sid.assa@sydney.edu.au

Research Areas:

Nanophotonics; Light scattering; Radiative cooling

Project Description:

This project aims to develop self-cooling paints and coatings based on nanoparticle engineering to address the growing demand for sustainable building materials.

To address the need for sustainable solutions in urban environments, this project explores whether paints and coatings can be engineered to remain cool under direct sunlight while maintaining their aesthetic appeal. The project will focus on the design and manufacturing of paints and coatings based on nanoparticles to achieve vibrant colouration through efficient light scattering with minimal heat-generating solar absorption. The outcomes of this project will contribute to the advancement of sustainable building materials and energy-efficient technologies.

Offering:

A scholarship for 3.5 years at the RTP stipend rate (currently $42,754 in 2026). International applicants will have their tuition fees covered.

Successful candidates must:

- Have a Bachelors degree (1st class honours or equivalent) or a Masters degree in Engineering or related field
- Must have at least a strong background in at least one of the following areas:
    - Light scattering theory (Mie scattering)
    - Computational modelling (e.g. scattering calculations, COMSOL Multiphysics)
    - Nanoparticle fabrication techniques

How to apply:

Please send the following to sid.assa@sydney.edu.au the following:

- CV
- Transcripts

Engineering thermal radiation in electronic devices

Supervisor:

Dr Sid Assawaworrarit - sid.assa@sydney.edu.au

Research Areas:

thermal photonics; semiconductor devices; nanoscale fabrication

Project Description:

This research project aims to engineer electronic devices that control radiation emission in the mid-infrared, with important applications in waste heat energy conversion, radiative cooling, and sensing.

Electronic devices aren't just for controlling the internal flow of electrons. What occurs within these devices can also manifest externally, such as through the emission of radiation—think of light from light-emitting diodes (LEDs). This project aims to engineer electronic devices that can offer control over radiation emission in the mid-infrared spectrum, which is critical for many thermal processes with important applications in waste heat energy conversion, radiative cooling, and sensing. Can we design such devices with controllable thermal radiation? What will these designs look like? How will they perform? These are the questions you will help us answer.

These following papers offer background information related to this project:

- **https://doi.org/10.48550/arXiv.2407.17751**
- **https://doi.org/10.1109/MSPEC.2023.10352423**
- **https://doi.org/10.1063/5.0134951**
- **https://doi.org/10.1038/nmat4043**

Offering:

A scholarship for 3.5 years at the RTP stipend rate (currently $42,754 in 2026). International applicants will have their tuition fees covered.

Successful candidates must:

- Have a Bachelors degree (1st class honours or equivalent) or a Masters degree
- Strong background in semiconductor & photonic device modelling, fabrication and characterisation
- Research experience preferably with at least one publication
- Strong communication skills

How to apply:

Please send the following to **sid.assa@sydney.edu.au** the following:

- CV
- Transcripts

Nanostructured Textiles for a Sustainable Warming World

Supervisor:

Dr Alex Song – **alex.song@sydney.edu.au**

Research Areas:

Sustainable energy, Nanomaterials, Nanophotonics

Project Description:

Did you know even the lightest clothing can create a personal greenhouse effect, keeping you warmer than you'd like? Researchers from the schools of Engineering, Physics, Chemistry, Architecture, and Health are investigating nano-structured fabric and textile fibres which can reduce this greenhouse effect. By

controlling solar and thermal radiation, our aim is to develop innovative clothing that can keep you cooler indoors and in full sun.

In our modern society, the demand for energy efficiency, recycling, and harvesting is pressing. Nano control of radiation provides unique opportunities for sustainable energy, with a wide range of applications including human-body cooling, building cooling, and heat recycling. If you are passionate about photonics, thermal physics, materials, or nanoscience, we invite you to explore and contribute to this captivating research area.

Further Information:

One to two scholarships. For domestic or international students.

Interested students please email their CV, transcript, and any other relevant info to **alex.song@sydney.edu.au** and **boris.kuhlmey@sydney.edu.au**

Quantum Topological Photonics

Supervisor:

Dr Alex Song – **alex.song@sydney.edu.au**

Research Areas:

Topological Phases; Quantum Optics; Nanophotonics

Project Description:

Quantum states of light have been extensively studied for various applications such as quantum computation, quantum communication, and metrology. Yet, the media that carry and transport the nonclassical light are typically fibres, dielectric cavities or waveguides, or vacuum, which are themselves topologically trivial. We will study the quantum effects of light in the presence of non-trivial topology. To this end, we will design and fabricate nanophotonic structures with different topological phases. Both Hermitian and non-Hermitian topological bands will be employed on this platform. We will examine the dynamics of single photons, entanglement, and quantum noise under the tailored density of states, dispersion, and chirality. We will engage in both theoretical and experimental studies. With the new topological degrees of freedom, we hope to address pressing issues such as robustness and scaling in quantum information processing.

Further Information:

1-2 scholarships are available for this project. The start date is flexible. Applications from both domestic and international students are welcomed.

Augmented Reality for the Visually Impaired – Sensory Augmentation

Supervisor:

Associate Professor Craig Jin – **craig.jin@sydney.edu.au**

Project Description:

The Computing and Audio Research Lab at the University of Sydney, Australia has a fully-funded PhD position open in augmented reality for the visually impaired, in partnership with ARIA LLC.

Applicants with a strong background in Psychoacoustics, Computer Science, Software Engineering or similar programs are encouraged to apply.

Project ARIA, Augmented Reality in Audio, seeks to endow the visually impaired with a richer sense of their surroundings using a wearable augmented reality device. Building on technologies from robotics, augmented reality, and spatialised audio display, ARIA will deliver next-generation auditory sensory augmentation with the potential to improve the quality of life for millions of people affected by vision impairment worldwide.

There are multiple PhD projects available in Project ARIA. This Sensory Augmentation-focused project will advance the auditory sensory augmentation technologies required for the ARIA wearable device to perform reliably and efficiently in a breadth of usage scenarios.

We take a broad view of auditory sensory augmentation as comprised of three parts: (1) sensors and machine artificial intelligence extract information for a targeted objective; (2) this information is rendered via the auditory channel as sound; (3) we enable efferent feedback control via hand/wrist or other sensors. Experiments are run using motion capture and the latest AR/VR/XR equipment. The challenges are to convey navigation, social, or symbolic information via the auditory channel in perceptually consistent and meaningful ways.

The project's aims include:

- Establishing a psychoacoustic simulation environment to support rapid development and evaluation of novel auditory sensory augmentation paradigms
- Adapting computational imaging technologies to propose novel methods for auditory sensory augmentation
- Characterising and calibrating auditory sensory augmentation paradigms via simulation, controlled lab experiments, and user trials
- Developing auditory sensory augmentation algorithms to best make use of incoming machine vision sensor information
- Supporting development of the high-level sensory augmentation algorithms and the full sensory augmentation pipeline

Research Environment

Embedded in the School of Electrical and Computer Engineering, the Computing and Audio Research Lab (CARLab) is focused on auditory sensory augmentation, machine hearing, and morphoacoustics (morphoacoustics.org). We employ audio signal processing and machine learning techniques to develop new concepts and understandings that will provide new technologies for auditory sensory augmentation and machine hearing.

CARLab offers specialised acoustic facilities (anechoic chambers, semi-anechoic chamber, loudspeaker arrays, linear and spherical microphone arrays, AR/VR/XR platforms). You will have access to mechanical and electronics workshops and a pool of technical staff to help realise your research ambitions. You will also have the opportunity to work closely with Project ARIA's engineers and make use of their extensive development and testing facilities. The University of Sydney offers a rich academic setting in a world-class city, and CARLab has strong ties to a network of nearby and international academic and industrial collaborators.

Offering

A fully funded 3-year PhD scholarship covering tuition fees and a stipend covering living expenses, with extension to 3.5 years contingent on availability of funding.

Successful candidates will have:

- A bachelor's degree in a relevant discipline
- Interest in developing novel auditory sensory augmentation systems and working with AR/VR/XR simulation environments
- Excellent communication and interpersonal skills
- Experience with one or more of psychoacoustics, computer science, software engineering, audio signal processing, sound design and engineering
- Hands-on experience with Python, Matlab, C++, and one or more video game simulation environments would be an asset

Domestic and international applicants are welcome.

How to Apply

Email **craig.jin@sydney.edu.au** to discuss your suitability and how to apply.

Real-Time Magnetic Resonance Imaging for Vocal Tract Analysis

Supervisors:

Associate Professor Craig Jin – **craig.jin@sydney.edu.au**

Professor Kirrie Ballard – **kirrie.ballard@sydney.edu.au**

Project Description:

The Computing and Audio Research Lab at the University of Sydney, Australia has a fully funded PhD position open to support real-time magnetic resonance imaging (rtMRI) and analysis together with acoustic-phonetic analysis. A particular focus for the imaging/acoustic processing and analysis is to support a study of the developmental trajectory of tongue control. This project is conducted in collaboration with University of York, Macquarie University, and the Discipline of Speech Pathology at the University of Sydney. Applicants with a strong background in Electrical, Computer Engineering, Computer Science, or similar programs are encouraged to apply.

This research seeks to develop rtMRI capabilities for vocal tract analysis in Australia, expand our knowledge of the morphoacoustics (morphoacoustics.org) of the vocal tract and assist with improved understanding and techniques within the field of Speech Pathology.

Challenges arise to validate, correlate, and relate the imaging and acoustic data obtained from vocal tract rtMRI (VT-rtMRI). We will be creating, collecting and analysing an Australian speech database. Research areas of interest are statistical and machine learning techniques to assist with the data analysis and processing. In particular, VT-rtMRI offers the ability to form an improved understanding of the relationship between articulation, acoustics and perception.

The project's aims include:

- Characterising the relationship between dynamic tongue configuration and speech acoustics, and how this relationship changes as the participants grow

- Developing computational imaging and acoustic analysis technologies for establishing these links including novel methods for processing rtMRI images of the vocal tract
- Supporting development of tools to support rtMRI vocal tract imaging and analysis

Research Environment

Embedded in the School of Electrical and Computer Engineering, the Computing and Audio Research Lab is focused on signal processing and machine learning approaches to support morphoacoustic and auditory sensory augmentation research and offers rich collaboration and supervision spanning multiple departments and universities: (Amelia Gully, forensic and acoustics, University of York), (Kirrie Ballard, Speech Pathology, The University of Sydney), (Michael Proctor, speech production, perception, and phonological organisation, Macquarie University), (Luping Zhou, medical imaging and machine learning). We will conduct our research using imaging facilities at Westmead Hospital.

Offering

A fully funded 3.5-year PhD scholarship covering tuition fees and a stipend covering living expenses.

Successful candidates will have:

- A bachelor's degree in a relevant discipline
- Interest in developing acoustic and imaging analysis systems for VT-rtMRI.
- Excellent communication and interpersonal skills
- Experience with one or more of acoustics, audio signal processing, imaging, image processing and/or computer vision
- Hands-on experience with MATLAB, Python, and Deep Learning frameworks would be a strong asset

Domestic and international applicants are welcome.

How to Apply

Email craig.jin@sydney.edu.au to discuss your suitability and how to apply.

Direct Signal Processing

Supervisors:

Professor Xiaoke Yi – xiaoke.yi@sydney.edu.au

Dr Liwei Li – liwei.li@sydney.edu.au

Research Area:

Direct signal processing, IoT, Artificial Intelligence

Project Description:

The rolling out of the internet of things which seeks to connect and integrate billions of devices together, and the increasing need for artificial intelligent systems continually demand more bandwidth, higher speed signal processing. Direct signal processing in optical domain has the potential to realize orders of magnitude increase in instantaneous bandwidth, and a very high sampling frequency ability (over THz in comparison to around GHz with electronic technology), which lead to diverse applications for tackling problems of processing wideband signals, and for high-throughput sensing. This project focuses on light weight, small size and low power consumption integrated photonic circuits for signal processing and

sensing, which has applications in environmental monitoring, broadband communications, datacenter, health care, quantum information processing.

Further information:
If you are interested, please email a concise CV (1 page), academic transcripts and a short description of why you are interested to Professor Yi.

Logic Development of MAC Systems for Wireless Communications

Supervisor:

Dr Wibowo Hardjana – wibowo.hardjawana@sydney.edu.au

Research Area:

Wireless Communications, 5G, 6G , Long-Range WiFi, IoT, Artificial Intelligence

Project Description:
This industrial PhD project will be jointly supervised with our industry partner, Morse Micro, a leader in the design and manufacturing of Wi-Fi HaLow solutions. Wi-Fi HaLow is based on the IEEE 802.11ah standard and targets long-range and wide-range wireless internet-of-things (IoT) applications with transmission rates ranging from 0.3 to 234 Mbps using the unregulated frequency band around 900MHz. Collision as a result of contention access has been identified as one of the issues that prevents achieving optimal wireless capacity in the above systems. The identified features that can control contention in IEEE 802.11ah are Target Wake Time (TWT), Restricted Access Window (RAW) and modulation coding rates (MCS). TWT permits an access point (AP) to define a specific time or set for individual stations to access the medium. RAW allows partitioning of the stations within a Basic Service Set (BSS) into groups and restricting channel access only to stations belonging to a given group at any given period. MCS determines the length of transmission frames. We will develop a mathematical formulation and artificial intelligence (AI) model for scheduler logic and validate the results via theoretical analysis and network simulators, culminating in hardware prototypes. The project will also investigate MAC level system performance for different operating bands (such as ISM 2.4 GHz band) and propose improvements on IEEE 802.11n MAC layers. The PhD candidate must be willing to spend between 50% and 75% of the time at the partner company offices when necessary and to adapt the research directions if needed.

Further information:

If you are interested, please email your up-to-date CV, transcript and a short description of why you are interested to Dr Hardjana

Future Wireless System Development Project (2 x PhD Scholarships)

Summary:

We are seeking two outstanding PhD candidates to join an ambitious Australian Research Council (ARC) Industry Laureate Fellowship project. The project will develop a future wireless system that unifies communication, sensing, and computing into a single network. This include developing fundamental theory and enabling technologies to achieve simultaneous communications, sensing, computing, and AI. In this project, the students will work closely with industry partners to translate the research outcomes into practical systems and solutions.

There are two 4 years' PhD scholarships to be filled. The successful students will be paid the full scholarship, including the stipend $41,753/p.a. and tuition fees.

Supervisors

Prof Yonghui Li

Successful Candidates:

- Must have a have a Bachelors degree (1st class honours or equivalent) or a Master's degree in Electrical Engineering, Telecommunications, or related fields and with a substantial research component in telecommunications, AI and Signal Processing.
- Students with strong background in MIMO, reconfigurable intelligent surface (RIS), and machine learning are strongly encouraged to apply.
- Students who are highly motivated, capable of independent research and strong motivations to collaborate with industry are also strongly encouraged to apply.

How to apply:

To apply, please email **yonghui.li@sydney.edu.au** with the subject line "PhD Application:" and your name.

Include the following:

- CV
- Transcripts
- A brief cover letter

Project Management Projects

Food System Transformation Projects: Leverage Points Towards Sustainable, Resilient, and Just Futures

Supervisor:

Dr Rachel Mazac

Research Area:

Food Systems; Transformation; Sustainability; Leverage Points; Resilience; Justice

Project Description:

Food systems face increasing pressures from climate change, biodiversity loss, food insecurity, and widening social inequities. While many interventions seek to address these challenges, they often target immediate problems rather than the deeper system structures that shape long-term outcomes. As a result, many food systems projects generate incremental improvements but fail to deliver lasting transformation.

Using comparative case studies of food system projects in Australian and international contexts, the research will explore how readiness conditions enable or constrain transformation, how projects target different leverage points, and how these factors interact to shape outcomes. This research will contribute new approaches for evaluating and designing food systems interventions that move beyond incremental change toward systemic transformation.

We welcome critically engaged candidates from diverse disciplinary backgrounds who are interested in working across boundaries, engaging with real-world food system challenges, and contributing to more just and sustainable transformation pathways.

Offering:

A scholarship for 3.5 years at the RTP stipend rate (currently $42,754 in 2026). International applicants will have their tuition fees covered.

Successful candidates must:

- Have a Master's degree in related field
- Have experience in qualitative, quantitative, or mixed research methods
- Demonstrate strong written and oral communication skills
- Experience in systems thinking, sustainability, resilience, or food system research (preferred, not required)

How to apply:

To apply, please email the following to **phd.projectmanagement@sydney.edu.au** with subject line "USYD PhD – Food Systems Transformations" by the application deadline of September 15, 2026:

- Cover letter (1 page) with interest in and motivation for applying
- Comprehensive CV with 2-3 references
- Official academic transcripts from Master's and Bachelor's level
- Research proposal (1 page) outlining a possible research direction of interest within the degree

Intelligent sensing and control for megaprojects

Supervisor:

Dr Wanchun Liu – **wanchun.liu@sydney.edu.au**

Research Areas:

Project Systems Engineering; Artificial Intelligence; Complex Project Management

Project Description:

Megaprojects—large-scale, complex ventures often characterized by uncertainty, interdependencies, and stakeholder fragmentation—present significant challenges in timely sensing, control, and governance. This PhD project seeks to advance the theoretical and technical foundations of intelligent project systems by developing AI-enhanced sensing and control mechanisms to manage emergent dynamics in megaproject execution.

The research will explore how machine learning, especially graph-based learning and reinforcement learning, can be embedded within project control architectures to dynamically monitor system states, predict risks, and recommend control actions. This project will also investigate human-AI collaboration strategies to ensure interpretability and trustworthiness of AI-supported decisions.

The expected outcomes include a novel framework for intelligent sensing and control in project environments, empirical validation through simulation or case study, and potential software prototyping based on Python.

Offering:

The successful candidate will be awarded a scholarship for 3.5 years at the RTP stipend rate (currently $42,754 in 2026) subject to satisfactory academic performance. International applicants will receive a tuition fee scholarship for up to 3.5 years.

Successful candidates must:

- Must have a Honours degree (First Class or First Class Honours Equivalent) or a Master's degree with a substantial research component
- Must have a strong background in project management, systems engineering, or related field
- Must have proficiency in Python and foundational knowledge in AI/ML (e.g., PyTorch, TensorFlow, or scikit-learn)
- Must have an interest in interdisciplinary research at the intersection of project governance, AI, and complex systems

How to apply:

To apply, please email Dr Wanchung Liu the following:

- CV
- Transcript, and
- A brief cover letter

Project capabilities for sustainable transition

Supervisor:

Dr Sujuan Zhang – **sujuan.zhang@sydney.edu.au**

Research Areas:

Project capabilities; Sustainable transition; Projecting; Owner Capabilities

Project Description:

Projects serve as practical vehicles for implementing change, testing new ideas, and scaling up solutions. Project capabilities play a pivotal role in driving sustainable transition in the project organising context. Both project owners and suppliers (project-based organizations) need to develop essential capabilities to drive sustainable transition.

Projects are considered as pivotal vectors for socio-technical change, in this context, sustainable transition. Such projects carry the intentions of owners and a broader set of stakeholders, through collaborative efforts, are aimed to achieve sustainable transition outcomes. How these complex projects (e.g. energy infrastructure projects) can be effectively delivered poses emerging challenges. This calls for the research into project capabilities required for relevant stakeholders involved in the project organizing domain. Among the key domains, the project owner, acting as the key decision-maker, investor, systems integrator, plays a leading role in the transition process. Hence, it is urgent to investigate how project owners organise their roles, develop essential capabilities to respond to changing sustainable requirements, and lead the sustainable transition through projects.

Offering:

A scholarship for 3.5 years at the RTP stipend rate (currently $42,754 in 2026). International applicants will have their tuition fees covered.

Successful candidates must:

- Have a Bachelor's degree (1st class honours or equivalent) or Masters degree
- Have experience in mixed research methods
- Have experience in qualitative research approaches (e.g. case study)

How to apply:

To apply, please email **sujuan.zhang@sydney.edu.au** the following:

- CV
- Transcripts

AI Techniques for Emergency Management and Critical Infrastructure

Supervisor:

Associate Professor Nader Naderpajouh – **nader.naderpajouh@sydney.edu.au**

Research Areas:

Climate Change

About the opportunity:

Two MPhil Scholarships opportunities to support research in "AI Techniques for Emergency Management and Critical Infrastructure" is being offered to Australian citizens or permanent residents. The scholarship includes a stipend of $42,754 p.a, in addition to $10,000 for training and, $5,000 for travel, a thesis allowance and it also covers tuition fees. The recipients will also have the opportunity to undertake a six-month internship with the industry partner and undertake training courses from the CSIRO on AI and analytics.

Successful candidates must have:

- Bachelor's degree or a master's degree in the relevant discipline, including Engineering, Business, Social Sciences, Science, Economics, etc.
- Be an Australian citizen or permanent resident.

How to Apply:

To enquire about this opportunity, please email nader.naderpajouh@sydney.edu.au, with the subject line "MPhil Application:" and your name. Include the following:

- CV
- Transcripts **(can be unofficial)**