A COLLABORATIVE PARTNERSHIP BETWEEN

THE UNIVERSITY of ADELAIDE | UNSW

DEFENCE TRAILBLAZER
CONCEPT TO SOVEREIGN CAPABILITY

Adaptive Control of Hypersonic Systems

Who can apply?

- Australian Citizens & Permanent Residents
- New Zealand Citizens
- Onshore international students from Five Eyes Alliance Nations

Program of study available

- Doctor of Philosophy (PhD)

Industry partner and funding body

- Lockheed Martin Australia
- Defence Trailblazer

Total annual stipend amount

- A base scholarship of $40,000pa plus $10,000pa top-up scholarship

Start date

- Must commence no later than February 2025

Benefits

- Work closely with skilled experts on defence industry led projects
- Translate research into a tangible solution for Defence
- $50,000pa tax-free* stipend (pro-rated for eligible part-time students)
- No tuition fees apply
- Acquire a unique set of skills and expertise
- Enhance your employability skills sought after by industry; graduates are highly regarded by employers
- Opportunities for local and international travel
- Work alongside world-leading researchers
- Gain industry experience and grow your networks
- Solve real life problems through industry engaged projects
- Publish your contributions
- Become an expert and make a real impact
- Access paid annual, parental and personal leave

About the project

Adaptive control is the control method used by a controller which must adapt to a controlled system with parameters which significantly vary, or are initially contain large uncertainties. In an adaptive control system, the controller parameters are adjusted automatically to compensate for changes in the dynamics of the system and process conditions.

Adaptive control of hypersonic systems is a very challenging tasks as hypersonic vehicles are subject to many large uncertainties and unknown disturbances such as unknown and uncertain aerodynamic parameters, thermal degradation, actuator saturation, failures, time-delays, elastic vibrations at sensor positions, vehicle shape distortion, environmental disturbances, unmodeled dynamics, etc. The objective is to develop an effective adaptive control system that adjusts the control parameters of the hypersonic vehicle based on the current flight conditions, such as altitude, speed, wind direction, thermal degradation, shape distortion, etc. This project aims to solve these challenges by developing effective modern adaptive control tools.

The research project will consist of three stages. The first stage involves developing sophisticated mathematical models for flying hypersonic vehicles taking into account uncertainties and unknown disturbances. The second stage addresses the problem of system identification for flying hypersonic vehicle. It requires applying system identification tools such as nonlinear Kalman filtering, particle filtering and robust extended Kalman state estimation. Edge AI tools such as deep reinforcement learning will also be used. Finally, the third stage will involve developing effective real-time adaptive control algorithms using advanced tools of modern control engineering such as adaptive sliding-mode control, adaptive model predictive control and adaptive H-infinity control. The project will be conducted in both simulation and on real platforms with hardware-in-the loop experiments.

Eligibility criteria

- Australian citizens and defence industry professionals are encouraged to apply.
- Applicants with strong experimental and numerical skills in robotics, computer vision or control systems will be considered favourably.
- Be willing to share Intellectual Property with the industry partner and University by way of a Student Deed Poll.

* Conditions apply

How to apply

- Complete an expression of interest
- The primary supervisor will assess your eligibility, and if successful, will prompt your application for admission via UNSW.

More about Defence Trailblazer

The Defence Trailblazer for Concept to Sovereign Capability is a once in a generation opportunity to strengthen the collaboration between defence, academia and industry whilst accelerating research and commercialisation.

In partnership with the University of Adelaide (UoA), the University of New South Wales (UNSW), industry partners and supported by the Australian Government, the initiative will skill the workforce of the future, support defence-focussed innovation, and play a leading role in accelerating the delivery of sovereign capabilities for the nation's security and prosperity...at-speed and at-scale.

Learn more: https://dtb.solutions/

Industry Research Program

All students supported under the Defence Trailblazer initiative will participate in the Defence Trailblazer Industry Research Program (IRP).

Candidates will be located on-site at both university and industry offices for at least 60 FTE days (pro-rated for eligible Masters candidates), to enable professional development opportunities in an industry setting.

Defence Research Capability

Academics participating in the Defence Trailblazer IRP are leaders in their fields.

UNSW adds a critical dimension to preparing defence forces across areas as diverse as Autonomous Systems, Hypersonics, Sensors and Space. The UNSW Defence Capability Portfolio showcases UNSW's excellence in defence research and technology and highlights work across academia, government and industry, as well as with global policy makers, to create a hub of defence-related knowledge. The vision is to translate this knowledge into impact which can transform Australian and global societies.

There's no greater reassurance for our community than knowing we're well prepared to prevent or avert threats to our security. UoA researchers support this in very domain: on land and online; in space, the air and at sea, working extensively with the Department of Defence and defence-related organisations in a variety of ways—as an advisor, research partner and producer of high-quality, career-ready graduates equipped to make our world a better and more secure place.

Learn more about UNSW's defence capability portfolios.

Further information

For a confidential discussion contact:

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Defence Trailblazer, together with UoA and UNSW, are actively working to support equity groups. We strongly encourage applications from people with a disability, veterans and women interested in working in non-traditional work settings

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