Australian National University

ANU PhD opportunities

Australian National University

Project 1

Project Name/Research Title	Optimisation of laser-assisted automated fibre placement (AFP) for manufacture of metal-composite hybrids
Project Description	The application of laser tape placement of thermoplastic composite (TPC) materials to the reinforcement of metallic components could enable manufacturing of high-value, lightweight hybrid structures in a flexible and efficient process. Hybrid sheet metal/carbon fibre epoxy reinforced structures have demonstrated good crash performance for automotive structures and offer significant weight saving potential. Compared with conventional thermoset composites, TPCs are tough and typically have specific impact energy absorption an order of magnitude higher. One possible avenue for rapid and flexible manufacture metal/TPC hybrids is to adapt the near infra-red (NIR) laser automated (robotic) fibre placement (AFP) process, which can heat and consolidate TPCs in less than one second. This project will develop a production-viable AFP process for reinforcement of metallic components with automated placement of unidirectional TPCs. The research will include investigation of surface texturing of metal substrates for optimal laser absorption and metal composite bond quality; metal-composite interaction with possible adhesive inclusion and/or treatments; thermal modelling and measurements of the bond line temperature history to understand the effects of process parameter settings; and analysis of process constraints, limits of geometrical complexity for automotive part manufacture and cycle times.
Academic Expectations	The Ideal candidate will have the following qualities: • Bachelor (Honours) or Master degree in Mechanical, Materials or Manufacturing Engineering; at 1st class or upper second class level, or equivalent. • Demonstrated research capability (e.g. through thesis work) in the area of fibre composite materials. • Evidence of industry experience relevant to the proposed field of study. • Demonstrated ability to create impact for industry partners. • Highly developed design, analysis, experimental and modelling skills for composite materials. • Highly developed interpersonal, communication and management skills.

UNSW
SYDNEY

UNSW PhD opportunities

Project 1

Project Name/Research Title	Hybrid deterministic/stochastic failure models for AFP composites
Project Description	There has been a tremendous growth of utilizing Automated Fibre Placement (AFP) to manufacture highly precise components and large structures like fuselage panels and wing skins for high-end applications in aircrafts and next generation of space vehicles. This additive manufacturing technology is gaining popularity due to its fast rate of material deposition, repeatability, ability to produce parts with complex geometry and reduction of material waste. The PhD candidate will perform cutting edge research in developing hybrid deterministic/stochastic failure models for AFP composites. This will involve conducting in-depth studies to determine the underlying deformation and failure mechanisms in AFP composites. Proposing and developing physically based constitutive/damage equations. Establish appropriate numerical schemes to solve the governing equations and implementing the scheme in commercially available finite element codes.
Academic Expectations	The Ideal candidate will have the following qualities: • you have a strong motivation for (and preferably a history of) conducting scientific research and working with complex questions; • you possess structured and creative problem-solving abilities; • you possess strong analytical and technical skills and take responsibility for the development of your work; • you can work independently as well as in team; • you have excellent English communication skills (written and presentation); • knowledge of fibre reinforced polymer composites is an advantage; • experience with computational mechanics is a prerequisite; • experience with programming in Python or Matlab is a clear advantage; • experience with experimental work is an advantage;

Project 2

Project Name/Research Title	Selective stiffness modification and performance prediction for composite components
Project Description	There has been a tremendous growth of utilizing Automated Fibre Placement (AFP) to manufacture highly precise components and large structures like fuselage panels and wing skins for high-end applications in aircrafts and next generation of space vehicles. This additive manufacturing technology is gaining popularity due to its fast rate of material deposition, repeatability, ability to produce parts with complex geometry and reduction of material waste. The PhD candidate will perform cutting edge research in selective stiffness modification and performance prediction of AFP. This entails the development of tools and technology to identify risks in the manufacturing process; locate likely defect locations; predict the as-manufactured properties; and predict the stiffness and strength of manufactured components.
Academic Expectations	The Ideal candidate will have the following qualities: • you have a strong motivation for (and preferably a history of) conducting scientific research and working with complex questions; • you possess structured and creative problem-solving abilities; • you possess strong analytical and technical skills and take responsibility for the development of your work; • you can work independently as well as in team; • you have excellent English communication skills (written and presentation); • knowledge of fibre reinforced polymer composites is an advantage; • experience with computational mechanics is an advantage; • experience with experimental work is an advantage;

Project 3

Project Name/Research Title	Robust composite design of thin-walled AFP composites
Project Description	There has been a tremendous growth of utilizing Automated Fibre Placement (AFP) to manufacture highly precise components and large structures like fuselage panels and wing skins for high-end applications in aircrafts and next generation of space vehicles. This additive manufacturing technology is gaining popularity due to its fast rate of material deposition, repeatability, ability to produce parts with complex geometry and reduction of material waste. The PhD candidate will perform cutting edge research in developing a design tool for robust thin-walled AFP composites. This will involve developing and validating a systematic approach taken to the design process.
Academic Expectations	The Ideal candidate will have the following qualities: • you have a strong motivation for (and preferably a history of) conducting scientific research and working with complex questions; • you possess structured and creative problem-solving abilities; • you possess strong analytical and technical skills and take responsibility for the development of your work; • you can work independently as well as in team; • you have excellent English communication skills (written and presentation); • knowledge of fibre reinforced polymer composites is an advantage; • experience with experimental work is an advantage;

Project 4

Project Name/Research Title	Stiffening regimes for maximum damage/impact resistance
Project Description	There has been a tremendous growth of utilizing Automated Fibre Placement (AFP) to manufacture highly precise components and large structures like fuselage panels and wing skins for high-end applications in aircrafts and next generation of space vehicles. This additive manufacturing technology is gaining popularity due to its fast rate of material deposition, repeatability, ability to produce parts with complex geometry and reduction of material waste. The PhD candidate will perform cutting edge research in identifying and developing stiffening regimes to improve the damage/impact resistance in composite structures. A numerical and experimental methodology will be developed and implemented in addition to experimental testing of composite structures under crush and impact loading conditions.
Academic Expectations	The Ideal candidate will have the following qualities: • you have a strong motivation for (and preferably a history of) conducting scientific research and working with complex questions; • you possess structured and creative problem-solving abilities; • you possess strong analytical and technical skills and take responsibility for the development of your work; • you can work independently as well as in team; • you have excellent English communication skills (written and presentation); • knowledge of fibre reinforced polymer composites is an advantage; • experience with experimental work is an advantage;

Project 5

Project Name/Research Title	Rapid minimum-damage automated machining of composites
Project Description	There has been a tremendous growth of utilizing Automated Fibre Placement (AFP) to manufacture highly precise components and large structures like fuselage panels and wing skins for high-end applications in aircrafts and next generation of space vehicles. This additive manufacturing technology is gaining popularity due to its fast rate of material deposition, repeatability, ability to produce parts with complex geometry and reduction of material waste. The PhD candidate will perform cutting edge research in rapid minimum-damage automated machining of composites. This will include developing methods/processes that give high material removal rates while maintaining acceptable tolerances and ensuring a good surface finish with minimal damage to the surrounding areas of the machined part.
Academic Expectations	The Ideal candidate will have the following qualities: • you have a strong motivation for (and preferably a history of) conducting scientific research and working with complex questions; • you possess structured and creative problem-solving abilities; • you possess strong analytical and technical skills and take responsibility for the development of your work; • you can work independently as well as in team; • you have excellent English communication skills (written and presentation); • knowledge of fibre reinforced polymer composites is an advantage; • experience with experimental work is an advantage;

Project 6

Project Name/Research Title	Composites repair and rework
Project Description	There has been a tremendous growth of utilizing Automated Fibre Placement (AFP) to manufacture highly precise components and large structures like fuselage panels and wing skins for high-end applications in aircrafts and next generation of space vehicles. This additive manufacturing technology is gaining popularity due to its fast rate of material deposition, repeatability, ability to produce parts with complex geometry and reduction of material waste. The PhD candidate will perform cutting edge research together with AMAC industry partners in understanding the effect of rework and repair on composite structures and determine methods of overcoming related issues that occur in service. The outcome of this research will be the development of high integrity rework procedures, repair procedures and manufacturing fabrication procedures that give the industry partners additional versatility in their operations.
Academic Expectations	The Ideal candidate will have the following qualities: • you have a strong motivation for (and preferably a history of) conducting scientific research and working with complex questions; • you possess structured and creative problem-solving abilities; • you possess strong analytical and technical skills and take responsibility for the development of your work; • you can work independently as well as in team; • you have excellent English communication skills (written and presentation); • knowledge of fibre reinforced polymer composites is an advantage; • experience with experimental work is an advantage;