



University of
Nottingham
UK | CHINA | MALAYSIA



NIMTE

UNNC-NIMTE, CAS Doctoral Training Partnership

It's essential that you have contacted the [UNNC](#) and/or [NIMTE](#) supervisors and agreed on a suitable collaborative PhD topic before submitting an application.

Formal applications should follow the instructions in '[How to apply](#)' section.

Research areas

- New Material Science
- Advanced Manufacturing
- Electrical Machines and Drives
- Composite Materials
- Computer Science

Available PhD topics

PhD topic	Development of Advanced Drone Systems for Reliable Transport of Sensitive Liquids Using AI and Isolation Technologies
NIMTE Supervisor	Prof. Jiqiang Wang
UNNC Supervisor(s)	Dr Chung Ket Thein
Short introduction & description of the PhD project	<p>This project aims to develop an advanced drone-based system for the delivery of liquid drugs, which are vulnerable to vibration-induced issues such as bubble formation during transport. To address this challenge, the study will focus on creating an active control system for the storage box containing the liquid drug. This system will minimize vibrations during flight, preventing bubble formation and ensuring the stability of the drug.</p> <p>In addition, the project will introduce an innovative structural design for the storage box, incorporating vibration isolation techniques such as inerters or pivot systems. These mechanical systems will decouple the storage box from the drone's movements, providing a more stable environment for the liquid drug. Furthermore, the energy harvested from the drone's motion will be integrated into the system to power the active control mechanism, creating a more sustainable and efficient solution.</p>

	<p>AI will play a central role in optimizing the system's performance. Machine learning algorithms will be employed for real-time monitoring and dynamic adjustment of the active control system, reducing vibrations based on varying flight conditions. AI will also be used to optimize the drone's flight path, adjusting for environmental factors such as wind and altitude to ensure smoother travel. Additionally, predictive AI models will help anticipate maintenance needs and optimize the energy harvesting process, improving the system's overall reliability and performance. This research aims to create a robust, intelligent, and autonomous drug delivery system that enhances the safety and efficiency of liquid drug transport, advancing both healthcare delivery and drone-based vibration isolation technologies.</p>
Contact points	<p>Informal inquiries may be addressed to Prof. Jiqiang Wang (wangjiqiang@nimte.ac.cn) and Dr Chung Ket Thein (chungket.thein@nottingham.edu.cn).</p>
PhD topic	<p>Development of AI-Optimized Structures for Marine Vibration and Noise Control with Energy Harvesting Integration</p>
NIMTE Supervisor	<p>Prof. Jiqiang Wang</p>
UNNC Supervisor(s)	<p>Dr Chung Ket Thein</p>
Short introduction & description of the PhD project	<p>The marine industry faces critical challenges in vibration and noise control, which impact operational efficiency, structural integrity, and acoustic stealth. Excessive vibrations and noise not only compromise the performance and lifespan of marine systems but also contribute to environmental noise pollution, adversely affecting marine ecosystems. Existing solutions, such as passive damping and active control, are often energy-intensive, complex, and inadequate for the highly dynamic and broadband vibrational environments found in marine applications. Furthermore, integrating artificial intelligence (AI) to optimize vibration and noise control structures while leveraging energy harvesting remains largely unexplored.</p> <p>This research proposes the development of AI-optimized structures for vibration and noise control in marine environments with integrated energy harvesting capabilities. By designing advanced structural configurations and leveraging smart materials, this study aims to achieve superior vibration isolation and noise suppression while harvesting residual vibrational energy as a renewable power source. The integration of AI-driven optimization will enable the design of multifunctional structures that adapt to complex dynamic environments and deliver consistent performance. Secondary energy harvesting will power onboard systems, such as sensors and control units, reducing reliance on external power supplies and enhancing energy efficiency.</p> <p>The study combines computational modeling, AI-based design optimization, and experimental validation to address the limitations of current technologies. The expected outcomes include innovative marine structures that offer enhanced vibration and noise control, reduced acoustic signatures, and energy-sustainable solutions. These advancements will address critical research gaps, comply with environmental regulations, and support the marine industry's goals of sustainability, operational efficiency, and stealth.</p>

Contact points	Informal inquiries may be addressed to Prof. Jiqiang Wang (wangjiqiang@nimte.ac.cn) and Dr Chung Ket Thein (chungket.thein@nottingham.edu.cn).
PhD topic	Image Geolocation Estimation Based on Large Models
NIMTE Supervisor	Prof. Jiangjian Xiao
UNNC Supervisor(s)	Assoc. Prof. Dr. Kian Ming Lim
Short introduction & description of the PhD project	<p>Image geolocation estimation using large models is a technology that utilizes extensive pre-trained models to determine the geographic location of objects within an image or the location where the image was captured.</p> <p>Large models have strong feature extraction capabilities, allowing them to automatically generate rich feature representations from images. By integrating the visual features of an image with other modalities, such as text and geographical coordinates, a multimodal fusion process can significantly improve the accuracy of image positioning. Compared to traditional positioning methods, image geolocation estimation utilizing large models can learn from vast amounts of data and perform complex feature extraction, significantly enhancing accuracy.</p> <p>However, training large models typically requires a substantial amount of labeled data, and acquiring high-quality labeled image data often demands significant manpower, resources, and time. The distribution and characteristics of the data can vary across different fields and application scenarios. Consequently, developing a robust image geolocation estimation for unknown tasks remains a challenging problem.</p>
Contact points	Informal inquiries may be addressed to Prof. Jiangjian Xiao (xiaojj@nimte.ac.cn) and Dr. Kian Ming Lim (Kian-Ming.Lim@nottingham.edu.cn).
PhD topic	AlN-based high electron mobility transistor (HEMT) and its application in high-power electronic system
NIMTE Supervisor	Prof. Wei Guo
UNNC Supervisor(s)	Dr. Zhuang Xu
Short introduction & description of the PhD project	<p>GaN high-electron-mobility-transistor (HEMT) offers fail-safe operations and simple parasitic circuits, therefore being intensively pursued in consumer electronics, photovoltaic inverters etc. To achieve high breakdown voltage of the device and high reliability of the power module, AlN has emerged as a novel alternative building block during the fabrication of the HEMT. However, several challenges still remain before the commercial application, including poor crystalline quality of GaN/AlN heterostructure, high buffer leakage current and unstable V_{th} shift. There is stringent requirement for deeper understanding on the device architecture and its operation mechanism in power electronic system. This project will focus on: 1) MOCVD epitaxy and strain control of GaN HEMT devices with AlN buffer; 2) HEMT structure design and electrical performance evaluation; 3) Circuit design and application in Micro-grids using multi-port Active Bridge Converters.</p>
Contact points	Informal inquiries may be addressed to Wei Guo (guowei@nimte.ac.cn) and Zhuang Xu (John.XU@nottingham.edu.cn).

PhD topic	Research on the high-speed point-to-point motion control of the semiconductor bonding machine's XY motion platform
NIMTE Supervisor	Prof. Chi ZHANG
UNNC Supervisor(s)	Dr. Dunant HALIM
Short introduction & description of the PhD project	<p>The XY motion platform, a pivotal component of semiconductor packaging equipment, is a critical factor constraining the precision and efficiency of packaging devices. The project addresses the performance requirements of high-quality semiconductor packaging equipment, specifically focusing on the high-speed and high-precision XY motion platform. Linear motors are widely used in semiconductor manufacturing equipment due to their superior dynamic performance and positioning accuracy compared to rotary motors with ball screws. However, the control performance of linear motors is affected by various factors, such as time delay, disturbances, and model uncertainties.</p> <p>The segmented ternary composite control method is developed. The motion-profile-based feedforward controller is only engaged during the motion tracking period, and the disturbance observer (DOB) is employed exclusively during the settling period to attain precise positioning while minimizing the negative impact on dynamic performance. However, the residual vibration during the settling period is not sufficiently suppressed, nonlinear disturbances are not specifically compensated, and dual-axis synchronous control is not achieved.</p> <p>Therefore, this project will focus on three major dimensions:</p> <ul style="list-style-type: none"> (i) designing more effective residual vibration suppression strategies; (ii) minimizing the impact of thrust fluctuation and nonlinear friction on the trajectory tracking accuracy of linear motors; (iii) studying the coupling mechanism between the X-axis linear motor and the Y-axis linear motor and achieving dual-axis synchronous control.
Contact points	Informal inquiries may be addressed to Dr. Dunant HALIM (dunant.halim@nottingham.edu.cn) and Prof. Chi ZHANG (zhangchi@nimte.ac.cn).
PhD topic	Synthesis of MOF-Derived Dual-Metal M1-M2-N-C Nanocomposites with High-Electrocatalytic Activity for Oxygen Reduction Reaction and Zinc-Air Batteries
NIMTE Supervisor	Prof. Degao Wang
UNNC Supervisor(s)	Dr. Mengxia Xu
Short introduction & description of the PhD project	<p>Zinc-air batteries (ZABs) are among the most promising energy storage technologies due to their high theoretical energy density, low cost, safety, and environmental friendliness. However, their performance is significantly limited by the sluggish oxygen reduction reaction (ORR) at the cathode. Enhancing ORR activity and improving the utilization of metal catalysts require reducing catalyst particle sizes to the nanoscale.</p>

	<p>This PhD project focuses on developing high-performance dual-metal M1-M2-N-C electrocatalysts derived from metal-organic frameworks (MOFs) for ORR and ZAB applications. MOFs, known for their highly crystalline structure, large surface area, and tunable properties, serve as ideal templates for constructing advanced single-atom catalysts (SACs). Transition metal-nitrogen-doped carbon (M-N-C) materials derived from MOFs have shown great promise as ORR electrocatalysts. This research aims to synthesize novel MOF-derived dual-metal catalysts, optimize their performance, and investigate the underlying reaction mechanisms, contributing to the advancement of efficient and sustainable ZAB technologies.</p>
Contact points	<p>Informal inquiries may be addressed to Dr. Mengxia Xu (Mengxia.Xu@nottingham.edu.cn) and Prof. Degao Wang (wangdegao@nimte.ac.cn).</p>
PhD topic	<p>Development of high-thermal-conductivity Si₃N₄ ceramic substrates for thermal management in high power semiconductor devices</p>
NIMTE Supervisor	<p>Prof. Yinsheng Li</p>
UNNC Supervisor(s)	<p>Dr. Hao Chen</p>
Short introduction & description of the PhD project	<p>High power semiconductor devices play a critical role in fields such as 5G communications, new energy vehicles, defense, and aerospace. The trend towards miniaturization and high integration of electronic devices has led to a significant increase in heat generation, with thermal failure becoming the primary challenge affecting device performance and lifespan. Therefore, effective thermal management is crucial for these devices. Silicon nitride (Si₃N₄) ceramic is emerging as a next-generation substrate material for high power semiconductor devices, providing essential functions such as heat dissipation, insulation, and mechanical support.</p> <p>One of the bottleneck issues for Si₃N₄ ceramic substrates is their insufficient thermal conductivity (≤ 90 W/mK). There is an urgent need to develop Si₃N₄ ceramic substrates with higher thermal conductivity (≥ 120 W/mK) to facilitate the advancement of devices towards higher integration and power density.</p> <p>Since the thermal conduction mechanism in Si₃N₄ ceramics relies on phonon transport, defects within the grains and along the grain boundaries can cause phonon scattering, leading to reduced thermal conductivity. Thus, this project aims to reduce defects that scatter phonons through microstructure design, specifically by lowering lattice oxygen content and minimizing grain boundaries and intergranular phases. This can be achieved by using high-purity silicon powder instead of imported Si₃N₄ powder as raw materials, designing efficient sintering aids, and optimizing molding and sintering processes. The ultimate goal is to produce Si₃N₄ ceramics with high thermal conductivity (≥ 120W/mK).</p>
Contact points	<p>Informal inquiries may be addressed to Dr. Hao Chen (Hao.Chen@nottingham.edu.cn) and Prof. Yinsheng Li (liyisheng@nimte.ac.cn).</p>
PhD topic	<p>Radiative cooling based upon the optical modulation of optical materials and the dual-band spectral manipulation of thin film system.</p>

NIMTE Supervisor	Prof. Hongtao Cao
UNNC Supervisor(s)	Dr. Hao Chen
Short introduction & description of the PhD project	<p>The application of radiative cooling can be traced back to ancient time as the ancestors made ice in the nocturnal time even the ambient temperature is above 0 °C. This approach can passively decrease the ambient temperature through heat radiation without energy consumption, providing a solution to compensate problems raised by global warming. The scientific concept of radiative cooling first came up in 1826, whose critical point is to enhance the heat exchange between the Earth and the outer space within the atmospheric window (AW, 3-5, 8-13, 16-28 μm), while prevent the systemic solar irradiance absorption (0.2-2.5 μm). Therefore, the project mainly focuses on the spectral manipulation of thin film system. Besides, considering the performance optimization and integration of the designed film system, the project also involves the optical modulation of the relative materials, including the broadening of the absorption band and the enlargement of the resonance dielectric refractive index.</p> <p>This project will focus on two major optical dimensions on (i) high reflection in solar irradiance range and (ii) selective absorption in infrared regime.</p>
Contact points	Informal inquiries may be addressed to Prof. Hongtao Cao (h_cao@nimte.ac.cn) and Dr. Hao Chen (Hao.Chen@nottingham.edu.cn).
PhD topic	Development and Optimization of High-Efficiency All-Perovskite Tandem Solar Cells
NIMTE Supervisor	Prof. Chang Liu
UNNC Supervisor(s)	Prof. Bencan Tang
Short introduction & description of the PhD project	<p>This PhD project focuses on the development and optimization of all-perovskite tandem solar cells, which are designed to surpass the efficiency limits of traditional single-junction perovskite solar cells. By combining multiple perovskite layers with complementary bandgaps, tandem solar cells have the potential to harness a broader spectrum of sunlight, improving overall energy conversion efficiency.</p> <p>The project explores various aspects of tandem cell design, including the fabrication of high-quality perovskite films, interface engineering, and the integration of different perovskite materials with ideal bandgap alignment. Key challenges in this research include optimizing material compatibility, minimizing recombination losses, and achieving stable performance under operational conditions.</p> <p>Ultimately, the project aims to develop flexible, scalable, high-efficiency all-perovskite tandem solar cells, contributing to the advancement of solar energy technology and supporting the transition to renewable energy sources.</p>
Contact points	Informal inquiries may be addressed to Prof. Chang Liu (liuchang1@nimte.ac.cn) and Prof. Bencan Tang (bencan.tang@nottingham.edu.cn).
PhD topic	An Intelligent Energy Management System for Hybrid-Electric Ultra-Long Endurance Aircraft

NIMTE Supervisor	Xinmin Chen , Jiqiang Wang
UNNC Supervisor(s)	Richard Adjei , Salman Ijaz
Short introduction & description of the PhD project	<p>The growing demand for carbon emission reduction and in global fossil energy use has initiated the need for novel propulsion architectures that contribute to high energy efficiency and long endurance flights of air transport. One key challenge has been its endurance or long hours of flight. Although lithium-ion/lithium polymer batteries have high energy density, their low power density, long charging time, reduced endurance and increase in weight and cost make them not suitable for such civil applications. Hybridisation of the propulsion system is considered the most suitable architecture for highly efficient long endurance UAVs and small aircrafts. It allows combining the advantages and performances of different power sources and balancing their limitations. Hybrid fuel cell and battery power supply have the benefits of increased endurance due to high energy and power densities, energy generation and storage. Such architectures require an active energy management system (EMS) that optimizes the power consumption, fuel use and heat dissipation from the powertrain components including the fuel cell and batteries. Based on the idea of complementary advantages, the hydrogen fuel cell, energy storage batteries and other energy sources are combined for long endurance aircrafts. Research work will focus on (i) energy power system topology configuration and processing of multi-electric hybrid energy management methods; (ii) active energy management system based on machine learning realizes remote control and information collection of energy system, intelligent hybrid and adaptive charging of energy storage battery. The active energy management system with the converter as the core provides efficient hardware and software support for energy management control. Further studies will include (iii) the complex coupling relationship between mixed energy sources, energy and flight attitude, flight trajectory, and wind field and the development of an attitude and flight track control system. Demonstration applications will be realized on a high aspect ratio long endurance UAV. The UAV performance indicators: cruise speed 20 m/s, hydrogen storage ratio 7% (tentative), target flight time 12-24hrs.</p>
Contact points	<p>Informal inquiries may be addressed to Dr. Richard Adjei (richard-amankwa.adjei@nottingham.edu.cn) and Professor Xinmin Chen(chenxinmin@nimte.ac.cn).</p>
PhD topic	Adaptive Control of Hybrid Octoplane UAV in Dynamic Agriculture Environment.
NIMTE Supervisor	Xinmin Chen , Jiqiang Wang
UNNC Supervisor(s)	Richard Adjei , Salman Ijaz
Short introduction & description of the PhD project	<p>Agriculture has benefited from many technical advances in recent years. UAVs along with cutting-edge technology are widely used in agriculture. The global agricultural drone market size was exhibited at USD 1.1 billion in 2022 and is projected to hit around USD 7.19 billion by 2032, growing at a CAGR of 20.7% during the forecast period 2023 to 2032. While the adaptive control of UAVs is a globally explored topic, the application within dynamic agricultural environments presents a unique and evolving challenge. The integration of hybrid UAVs in precision agriculture is gaining international attention, with research efforts primarily focused on optimizing efficiency, enhancing adaptability,</p>

	<p>and ensuring precision in spraying and monitoring tasks. This research aims to contribute to this dynamic landscape by addressing specific challenges encountered in the intersection of UAV control and the evolving agricultural context. This project is centered on the design and realization of an adaptive control system for a hybrid UAV designed with dual capabilities, encompassing both vertical-take-off-landing and fixed-wing modes integrated into single platform. The pioneering UAV design and control offers promising potential for significantly improving the efficiency and precision of pesticide spraying operation. The project initial phase entails the development of an accurate dynamical model of hybrid UAV equipped with spraying mechanism. Subsequently an adaptive control law will be designed to attain the precise maneuvering using two-loop (inner and outer-loop) control structure that should be capable of handling variable environment conditions, variable mass condition, malfunctioning of sensor and actuators. The proposed design will undergo rigorous evaluation and validation through simulations testing before proceeding to real-time implementation, ensuring a robustness and quantifiable assessment of its performance and assessment.</p>
Contact points	<p>Informal inquiries may be addressed to Dr. Richard Adjei (richard-amankwa.adjei@nottingham.edu.cn) and Professor Xinmin Chen(chenxinmin@nimte.ac.cn).</p>
PhD topic	<p>An Efficient Liquid Cooling System for Battery Thermal Management of an eVTOL Hybrid-Electric Aircraft</p>
NIMTE Supervisor	<p>Xinmin Chen, Jiqiang Wang</p>
UNNC Supervisor(s)	<p>Richard Adjei, Salman Ijaz</p>
Short introduction & description of the PhD project	<p>Currently, most eVTOL concepts consider only Lithium-ion battery powertrains due to their technological maturity. For these battery powered aircraft, the design of battery thermal management system (BTMS) is crucial as the waste heat of the electric propulsion system cannot be dissipated into the atmosphere by an exhaust. To have a highly effective BTMS, it should be able to address most thermal concerns, e.g, extracting higher heat loads during power-demanding flight phases such as long-period hovering and thermal propagation, for safe and efficient operations with acceptable weight penalties and capacity degradation. Results in the open literature show that liquid cooling can maintain the battery operating temperature within acceptable levels with a mass of less than 20% of the battery mass. It has been found that channelled liquid cooling is cost-effective with moderate BTMS weight and power. Furthermore, it is also important to minimize the onboard BTMS weight and power consumption. The BTMS weight reduces the specific energy of the battery pack, which will in turn reduce the eVTOL's aero-propulsive performance. In addition, higher BTMS power consumption results in less energy available for the flight. Other considerations may contain BTMS's noise levels, manufacturing costs, technological maturity, etc. This research project will focus on the following:</p> <ul style="list-style-type: none"> • Develop a TMS model-guided neural network (MGNN) for intelligent analysis of constrained TMS for only battery and hybrid-electric eVTOL considering mission fuel burn and battery sizing.

	<ul style="list-style-type: none"> • An efficient liquid cooling TMS design and optimization aimed at specific eVTOL mission requirements, weight, power consumption and aeropropulsive performance. • Implementation of the TMS system in a prototype eVTOL to assess the feasibility of the system considering the specific mission requirements.
Contact points	Informal inquiries may be addressed to Dr. Richard Adjei (richard-amankwa.adjei@nottingham.edu.cn) and Professor Xinmin Chen(chenxinmin@nimte.ac.cn).
PhD topic	Efficient Energy Harvesting and Power Management System of Triboelectric Motors for Distributed Electric Aircraft Propulsion
NIMTE Supervisor	Xinmin Chen , Jiqiang Wang
UNNC Supervisor(s)	Richard Adjei , Salman Ijaz
Short introduction & description of the PhD project	<p>The growing demand for carbon emission reduction and in global fossil energy use has initiated the need for novel propulsion architectures that contribute to high energy efficiency and long endurance flights of air transport. One key challenge has been its endurance or long hours of flight. Although lithium-ion/lithium polymer batteries have high energy density, their low power density, long charging time, reduced endurance and increase in weight and cost make them not suitable for such civil applications. To mitigate the limitations with the applicability of the well advanced lithium ion/lithium polymer batteries technology in aircraft propulsion, different radical approach such as complete overhaul and redesign of propulsion system, propulsion system hybridization, distributed electric propulsion arrangement, etc., has been identified. Although each of the identified methods has achieved considerable improvement and trade-offs over the conventional propulsion designs, there is however a need to achieve a fully electric propulsion system which achieves a significantly improved power to mass ratio while achieving significant endurance or long hours of flight.</p> <ol style="list-style-type: none"> I. Taking advantage of the uniqueness of the distributed method of aircraft propulsion, this work will focus on achieving an efficient method for triboelectric energy harvesting from the core of the electric propulsion motors in different design variations. This stage will involve design of UAV motors that incorporate triboelectric mechanism for energy harvesting during motion. II. Deploy the motorized triboelectric harvester module for test in UAV using the distributed methods of propulsion. III. Design and deploy active energy management system for the triboelectrified motor configurations for electric aircraft applications. IV. Studying the complex relationship between flight attitude, flight trajectory, motor speed and wind field on the energy harvesting performances of the motor during take-off-cruise-landing. <p>The demonstration applications will be realized on a high aspect ratio long endurance UAV. The UAV performance indicators: cruise speed 20 m/s, target flight time 12-24hrs.</p>

Contact points	Informal inquiries may be addressed to Dr. Richard Adjei (richard-amankwa.adjei@nottingham.edu.cn) and Professor Xinmin Chen(chenxinmin@nimte.ac.cn).
PhD topic	Transonic Shock Buffeting and Aeroelastic Instability of Aeroengine WideChord Fan Blades
NIMTE Supervisor	Xinmin Chen , Jiqiang Wang
UNNC Supervisor(s)	Richard Adjei , Salman Ijaz
Short introduction & description of the PhD project	<p>In order to meet the key target of zero-emission aviation for cleaner and environmentally sustainable air transport, there is an increasing demand for novel propulsion architectures capable of high energy efficiency and long endurance flights of aircrafts and UAVs. To address the design challenges of nextgeneration aircraft and aeroengine blade design, it is important to gain deeper understanding into the transient nature of some key flow mechanisms that influences drag. Transonic buffet is a phenomenon that appears in compressible flow around an airfoil and plays a substantial role in the limitation of the flight envelope of commercial aircraft. It is a self-sustained shock oscillation in transonic flow which is not well-understood for turbofans and compressors. If the structural natural frequencies of the fan blade are similar to the buffet frequency, the oscillation of the compression shock, fluid, and structure may interact (transonic buffeting) and lead to strong loads and potential structural failure. Furthermore, research works have shown that structural parameters can have a significant effect on the onset point of shock oscillations as well as on the typology of the fluid–structure interaction, which presented classical structural excitation, modal veering, or frequency lock-in. This research work will focus on:</p> <ul style="list-style-type: none"> • Experiments and high-fidelity (LES) simulations of wave propagation in an unsteady flow solution featuring transonic buffet/shock oscillations will be investigated to understand the mechanism driving shock buffet in turbofan blades. • Aeroelastic analysis of shock oscillations and forced response mechanisms of turbofans. • Parametric studies to understand the influence of aerodynamic and structural parameters to help address the present challenges of transonic blade design.
Contact points	Informal inquiries may be addressed to Dr. Richard Adjei (richard-amankwa.adjei@nottingham.edu.cn) and Professor Xinmin Chen(chenxinmin@nimte.ac.cn).
PhD topic	A Novel Lightweight e-Hybrid Micro-Turbofan Design for Electrified Aircraft Propulsion
NIMTE Supervisor	Xinmin Chen , Jiqiang Wang
UNNC Supervisor(s)	Richard Adjei , Salman Ijaz
Short introduction & description of the PhD project	<p>In order to meet the key target of zero-emission aviation for cleaner and environmentally sustainable air transport, there is an increasing demand for novel propulsion architectures capable of high energy efficiency and long endurance flights of aircrafts and UAVs. For conventional aeroengines/batterypowered aircrafts, optimum</p>

	<p>efficiency of propulsion systems for specific flight conditions to power new aircraft configurations is very challenging. While turbojet engines may offer a simple design capable of providing high levels of thrust, they are usually marked by poor fuel consumption; turbofan engines, on the other hand, while being more complex and expensive, can provide similar or higher levels of thrust at a greater efficiency. In order to improve the performance while reducing the TSFC, which is considered to be the most influential engine characteristic relating to efficiency, the sensible solution is to introduce a turbofan into the microgas turbine category. If an efficient, wellperforming, affordable turbofan can be successfully designed, the application of microgas turbines may be expanded into fields for which were prior considered unsuitable.</p> <p>Currently, new aeroengine architectures are mainly used for manned aircraft due to their complexity, whereas the majority of small UAVs still uses propeller systems or simple turbojet engines. In this study, a novel concept for a small ehybrid variable bypass aeroengine is introduced with specific focus on small UAV and hybrid-electric propulsion architectures applications. Key aims/objectives are as follows:</p> <ol style="list-style-type: none"> 1. Define and design the thermodynamic cycle of a motor-driven Turbofan with bypass functions. 2. 3D design and sensitivity analysis of Turbofan stage with novel tandem stator profile using ASD parametric modelling 3. Multi-objective Design Optimization of the Turbofan stage using MOGA and ASD parametric modelling.
Contact points	<p>Informal inquiries may be addressed to Dr. Richard Adjei (richard-amankwa.adjei@nottingham.edu.cn) and Professor Xinmin Chen(chenxinmin@nimte.ac.cn).</p>
PhD topic	Study on Low-Temperature Densification and Reliability of SiC_f/SiC Composites Using Low Neutron Toxicity Sintering Aids
NIMTE Supervisor	Prof. Yinsheng Li
UNNC Supervisor(s)	Dr. Hao Chen
Short introduction & description of the PhD project	<p>Silicon carbide fiber-reinforced silicon carbide matrix composites (SiC_f/SiC) are highly valued for their exceptional high-temperature creep resistance, corrosion resistance, and radiation tolerance, making them crucial materials for high-safety cladding in harsh environments within the nuclear energy sector. The Nano Infiltration and Transient Eutectic (NITE) process is a significant method for fabricating SiC_f/SiC composites. However, key challenges hindering its application in nuclear energy include the introduction of sintering aids with high neutron absorption cross-sections and the detrimental effects of high densification temperatures on fiber integrity and mechanical performance. In this research subject, we propose the use of metal oxides with low neutron absorption cross-sections (such as Al₂O₃ and ZrO₂) as efficient sintering aids. By employing electric field-assisted rapid sintering techniques at lower temperatures, we aim to achieve densification of SiC_f/SiC while protecting the fibers and obtaining excellent mechanical properties. This study will investigate the physicochemical processes involved in the formation of liquid phases by the metal oxide aids, revealing</p>

	<p>the factors influencing the densification of SiC_f/SiC composites and clarifying the mechanisms of liquid-phase sintering.</p> <p>Furthermore, by examining the composition-microstructure-mechanical property relationships of SiC_f/SiC composites, we will elucidate the interaction principles between fibers, interfaces, and matrices under stress conditions, uncovering the failure mechanisms of the composites. This understanding will guide the optimization of microstructural design to enhance the mechanical performance of the composites. Finally, by studying the interactions between energetic particles and SiC_f/SiC composites at the atomic scale, we aim to clarify the irradiation damage mechanisms of materials in extreme environments.</p> <p>This research subject will provide theoretical support for the design and preparation of NITE-SiC_f/SiC composites.</p>
Contact points	Informal inquiries may be addressed to Prof. Yinsheng Li (liyisheng@nimte.ac.cn) and Dr. Hao Chen (Hao.Chen@nottingham.edu.cn).
PhD topic	Development of high-performance environmentally friendly perovskite light emitting diodes
NIMTE Supervisor	Dr. Chaoyu Xiang
UNNC Supervisor(s)	Dr. Hao Chen
Short introduction & description of the PhD project	<p>Metal halide perovskites based on Pb have been successful in various fields, including solar power generation, display, and lighting. However, the commercial application of Pb-based perovskites is hindered by the toxicity of heavy metal components. Additionally, current fabrication process of Pb-based perovskites involves toxic organic solvents such as dimethyl sulfoxide and energy-consuming steps like vapour deposition. The limitations of Pb-based perovskites make it difficult to meet environmentally friendly standards. Therefore, this project aims to fabricate high-performance, environmentally friendly perovskite light-emitting diodes. The project proposes the investigation of three directions: (i) designing non-toxic Pb-free perovskites, (ii) substituting current toxic solvents with green solvents, and (iii) developing energy-saving non-vacuum fabrication processes for Pb-free perovskite light-emitting diodes. The aim of this project is to create a new path for perovskite commercialization in the real world.</p>
Contact points	Informal inquiries may be addressed to Dr. Hao Chen (Hao.Chen@nottingham.edu.cn) and Dr. Chaoyu Xiang (xiangchaoyu@nimte.ac.cn).
PhD topic	Machine Learning-enabled composition and structure design of lightweight wear- and corrosion-resistant metal matrix composites
NIMTE Supervisor	Prof. Keke Chang
UNNC Supervisor(s)	Dr. Hao Chen
Short introduction & description of the PhD project	<p>This project aims to develop an AI-driven design and optimization loop of lightweight metal matrix composites (MMCs) by integrating machine learning and image recognition technologies. The focus is on using these advanced techniques to improve</p>

	the wear- and corrosion-resistance of MMCs synergistically. Specifically, the project will explore data-driven methods for predicting phase transformation behaviours, improving interface microstructures, and increasing manufacturing efficiency. The incorporation of image recognition will enable more accurate analysis and characterization of MMCs, and help to establish the interactive relationship of composition-structure-performance. This innovative approach promises to push the boundaries of material science, potentially leading to significant advancements in various modern industrial sectors.
Contact points	Informal inquiries may be addressed to Prof. Keke Chang (changkeke@nimte.ac.cn) and Dr. Hao Chen (Hao.Chen@nottingham.edu.cn).
PhD topic	Research on thermal-sprayed functional ceramic coatings with photothermal property
NIMTE Supervisor	Prof. Hua Li
UNNC Supervisor(s)	Dr. Hao Chen
Short introduction & description of the PhD project	<p>Photothermal materials hold immense potential in many applications ranging from energy conversion to thermal management systems. The ability to harness and manipulate photothermal effect in ceramic coatings can contribute to groundbreaking advancements in renewable energy, environmental engineering, smart material design, and other fields.</p> <p>Thermal spraying presents a versatile and effective method for fabricating these functional ceramic coatings. It allows for the deposition of coatings on a wide range of substrates, regardless of their melting points, providing a significant advantage in terms of material compatibility. Meanwhile, it offers the advantage of engineering coatings with specific microstructures and tailored properties.</p> <p>The main objective of this project is to develop and optimise ceramic coatings that demonstrate superior photothermal efficiency and durability via thermal spraying. By harnessing the advantages of thermal spraying, this project aims to deliver transformative solutions that are economically viable and technologically advanced, setting new benchmarks in the field of photothermal ceramic coatings.</p>
Contact points	Informal inquiries may be addressed to Prof. Hua Li (lihua@nimte.ac.cn) and Dr. Hao Chen (Hao.Chen@nottingham.edu.cn).
PhD topic	Electrolyte design for all-climate dual-ion batteries
NIMTE Supervisor	Prof. Gang Wang
UNNC Supervisor	Dr. Di Hu
Short introduction & description of the PhD project	The development of high-performance rechargeable batteries using cost-efficient and sustainable materials is critical to addressing the growing global demand for energy storage. Among various battery technologies, dual-ion batteries (DIBs) stand out as an ideal choice due to their high safety, low cost, high operating voltage, and straightforward configuration. A key component of DIBs is the electrolyte, which stores

	<p>and transports charge carriers while enabling vital electrochemical reactions at the anode and cathode.</p> <p>This project aims to develop novel electrolytes for DIBs capable of operating across a wide temperature range, making them suitable for all-climate applications. The research will explore a variety of cations, anions, and solvents to optimise performance. The solvation sheath structure of charge carriers will be thoroughly characterised and modelled to gain a deeper understanding of their behaviour. The resultant electrolyte properties will be evaluated in terms of ionic conductivity and electrochemical stability over a broad temperature range.</p> <p>Furthermore, the mechanisms of cation and anion storage at the anode and cathode will be investigated in details using advanced in-situ characterisation techniques.</p> <p>Ultimately, a prototype DIB will be demonstrated, integrating the novel electrolyte design with advanced electrode materials, highlighting its potential for reliable energy storage in diverse environmental conditions.</p>
Contact points	Informal inquiries may be addressed to Prof Gang WANG (gang.wang@nimte.ac.cn) and Dr. Di Hu (di.hu@nottingham.edu.cn).
PhD topic	Design of hollow fiber nanofiltration (NF) membranes for biopharmaceutical purification
NIMTE Supervisor	Prof. Jie GAO
UNNC Supervisor(s)	Prof. Yong REN
Short introduction & description of the PhD project	<p>The rising chronic disease prevalence has driven significant growth of the global biopharmaceutical market. Purification processes normally account for 60-80 % of the entire pharmaceutical production costs because (1) regulatory bodies normally have stringent requirements for purity and safety of pharmaceutical products; and (2) many active components and contaminants have similar molecular weights and sizes. Nanofiltration occupies the largest market share of membrane-based purification technologies and experiences the fastest growth rate due to its unique separation mechanisms of charge repulsion and size exclusion. This project will focus on optimization of hollow fiber nanofiltration membranes for biopharmaceutical purification, especially on (i) optimizing the fabrication of membrane supports through fluid dynamics, etc., and (2) investigating the suitable selective layer of the membranes.</p>
Contact points	Informal inquiries may be addressed to Prof. Ren (Yong.Ren@nottingham.edu.cn) and Prof. Gao (gaojie0993@nimte.ac.cn).
PhD topic	Design of thin-film nanocomposite membranes (TFN) for effective water treatment
NIMTE Supervisor	Prof. Jie GAO
UNNC Supervisor(s)	Prof. Yong REN
Short introduction & description of the PhD project	<p>Water scarcity is an important issue worldwide, especially in arid regions. The situation is getting worse in the next decades. The lack of water has severe impacts on food production, industrial productivity and domestic needs. To deal with water scarcity,</p>

	many efforts have been made to safely discharge and reuse the reclaimed wastewater. In this project, thin-film nanocomposite (TFN) membranes will be developed for water treatment. This project will focus on three major dimensions on (1) synthesizing nanofillers with uniform size distribution and functional groups; (2) fabricating TFN membranes using different nanofillers; and (3) optimizing TFN membranes with enhanced rejection and water permeability for water treatment applications.
Contact points	Informal inquiries may be addressed to Prof. Ren (Yong.Ren@nottingham.edu.cn) and Prof. Gao (gaojie0993@nimte.ac.cn).
PhD topic	Design and Control of Piezo-electric Driven Multi-DOF Compliant Mechanism
NIMTE Supervisor	Prof. Chen Silu
UNNC Supervisor(s)	Assoc. Prof. Dunant Halim
Short introduction & description of the PhD project	Compliant mechanisms are flexible mechanisms that transfer an input force or displacement to another point through elastic body deformation. The piezo-electric actuator has advantages of high-force density, high-precision, fast-reaction, thus becomes an ideal power source for the compliant mechanism. However, the methodology toward integrated design and control of the stage and the actuator to meet some specific ultra-precision applications, such as semi-conductors and bio-manufacturing is yet to be explored.
Contact points	Informal inquiries may be addressed to Prof. Chen Silu (chensilu@nimte.ac.cn) and Assoc. Prof. Dunant Halim (dunant.halim@nottingham.edu.cn).
PhD topic	High-Precision Control of Rotor-Based Systems with Vibration Suppression Strategies for Mechatronic and Robotic Applications
NIMTE Supervisor	Prof. Chen Silu
UNNC Supervisor(s)	Assoc. Prof. Dunant Halim
Short introduction & description of the PhD project	Rotor-based systems are widely used for mechatronic and robotic applications, such as for machining, manipulation and positioning tasks. To undertake high-performance tasks, high-precision control with effective vibration suppression strategies is essential. In particular, there is a need for the development of a control system that can address the complex rotordynamic behaviour, which can be significantly affected by internal and external disturbances, variable loads and system nonlinearities. Conventional control methods can be limited in their ability to adapt to changes in operating conditions, impacting the performance accuracy. Developing an effective vibration suppression strategy is also important for addressing vibrations that influence the accuracy. This project therefore aims to develop a control methodology for achieving high-precision control and effective vibration suppression of rotor-based systems.
Contact points	Informal inquiries may be addressed to Prof. Chen Silu (chensilu@nimte.ac.cn) and Assoc. Prof. Dunant Halim (dunant.halim@nottingham.edu.cn).
PhD topic	Highly efficient synthesis of electric fuel from CO₂

NIMTE Supervisor	Prof. Wanbing Guan
UNNC Supervisor(s)	Prof. Tao Wu
Short introduction & description of the PhD project	Electric fuel from CO ₂ is an important process for transforming and storing renewable electrical energy, and one of the main issues is stability, heat resistance and water resistance of catalytic reactor. This project aims to design a porous metal-ceramic reactor to produce electric fuel from CO ₂ at atmospheric pressure or low pressure. It requires the reactor has heat and water resistance characteristics. And the mechanism of catalytic reaction and stable operation shall be revealed. After research, it could provide a new approach to reactor design for the stable operation of CO ₂ -derived electric fuel at low temperature with high efficiency.
Contact points	Informal inquiries may be addressed to Prof. Tao Wu (tao.wu@nottingham.edu.cn) and Prof. Wanbing Guan (wbguan@nimte.ac.cn)