

## FoSE PhD research areas

### **Composites (Head of Research Group: [Prof. Xiaosu Yi](#))**

Research areas: Carbon fiber reinforced composites for aerospace, electrically conductive composites, lightning-strike protection composites, biomedical composites and application, bio-sourced resins and green composites, material recycling, composite manufacturing, composite modelling and simulation, structural damping composites, fire-retardant materials, noise absorbing and acoustically dark materials, 3D printing of composites, and thermoplastic composites.

### **Power Electronics, Machines and Control (Head of Research Group: [Prof. Chris Gerada](#)/[Prof. He \(Alan\) Zhang](#))**

Research areas: Power Electronics, Novel Electrical Machine Topologies, Drive Control, Mechanical Design, Thermal Management, Diagnostics and Health Monitoring, Power Converter, More Electrical Aircraft, Aerospace Electrification, New Energy Vehicle, Transport Electrification, Servo Motor Drive.

### **Geospatial and Geohazards (Head of Research Group: [Dr. Nicholas Hamm](#))**

Research areas: Our broad research areas are GIS and Infrastructure Engineering. Within GIS research areas include: remote sensing and in situ measurement, Earth observations for natural and urban environments, geospatial and environmental data science, positioning and navigation technologies, geohazards. Within Infrastructure Engineering research areas include: structures, earthquakes, geohazards, high-performance concrete, pavement stabilization, cycling infrastructure.

### **Advanced and Intelligent Manufacturing (Head of Research Group: [Prof. Xiaogang Yang](#))**

Research areas: Conventional & Non-conventional Material Removal Processes, Processes for Adding Materials, Modelling, Dynamics and Control of Manufacturing Processes, Reactive Manufacturing Processes, Chemical Reactors, Modelling of synthesis process of micro/nano functional particle materials, Multiphase flow modelling and simulation, Multiphase flow turbulence modelling, Automation of Manufacturing Processes and Process Planning and Lean Production, Industrial design.

**Natural Resources and Environment (Head of Research Group: [Prof. Jun He](#))**

Research areas: Air Quality and Pollution Control, Urban Climate Change, Water Quality and Wastewater Treatment, Aquatic Resource and Soil Management, Solid Waste Management and Treatment.

**Artificial Intelligence and Optimisation (Head of Research Group: [Prof. Ruibin Bai](#))**

Research areas: Computational Intelligence, Computer Vision and Image Processing, Transportation Analysis and Optimisation, Big Data, Health Informatics and Biomedical Informatics, Data Mining, Machine Learning, Software Testing, Computer Security, Computability and Complexity Analysis, Internet of Thing, Algorithms, Logic, Information Visualization, Human-Computer Interaction, Edge Computing, Deep Reinforcement Learning, 5G, Intelligent Sensors, Computational Economics.

**Advanced Energy and Environmental Materials & Technologies (Head of Research Group: [Prof. Cheng Heng Pang](#))**

Research areas: Advanced Composite Materials, Granular Materials and Geotechnology and New Energy and Environmental Materials.

**Fluids and Thermal Engineering (Head of Research Group: [Dr. Yong Shi](#))**

Research areas: Micro/nanoscale flows, Mass and heat transfer, Design of microfluidics and lab on a chip, Thermal management for energy systems, Multiscale (micro, meso and macro) modeling, Physicochemical transport processes in energy conversion and storage devices (batteries, fuel cells, Internal combustion engines and supercapacitors), Kinetic theory of gases, Space micropropulsion, Multiphase flows and heat transfer, Sustainable energy technologies, Machine learning approaches for thermofluids and energy analyses, Gas turbine aerodynamics and heat transfer, Multidisciplinary design optimization for aircraft and gas turbine design, Aerodynamic and aeroacoustic design of UAM electric propulsion systems.

**Partial Differential Equations (Head of Research Group: [Prof. Behrouz Emamizadeh](#))**

Research areas: Nonlinear Partial Differential Equations, Calculus of Variations, Nonlinear Analysis, Rearrangement Optimization Problems, Free Boundary Problems, Free Discontinuity Problems, Regularity of Solutions, Fractional Differential Equations,

Shape Optimization Problems, Eigenvalue Problems, Overdetermined and Symmetry Problems, Numerical Analysis, Finite Element Methods, Error Estimates, Mathematical modeling, Blow up problems in fluids, Navier-Stokes equations, Pattern formation, asymptotic methods, Childress conjecture on the Keller-Segel model and their generalization for several chemotactic species.

**Sensor, Sensor Networks, and Instrumentation (Head of Research Group: [Dr. Matthew Pike](#))**

Research areas: Health and Wellbeing (Medical Imaging, OMICS, Health Monitoring), Smart Systems (Smart Home/Office, Smart Vehicle, Smart Health), Applications of Sensors and Instruments (Diagnostics, Prognostics, Optimization).

**Sustainability and Innovation for Integrated Built Environment (Head of Research Group: [Dr. Wu Deng](#))**

Research areas: The SBE Research Group aims to promote multi-disciplinary research across two broad research themes: Architecture and urbanism (A + U), and Architectural Engineering, Environmental Design and Energy (AEDE). Among the many research topics that arise from the built environment, the following are of particular interest to the SBE Research Group:

1. Architectural humanity and history across various cultures, climates and geographic locations;
2. Past and contemporary urban transition and related sustainability issues in China and beyond;
3. Identification of best practices in the area of sustainable building and city development;
4. High performance building technologies and system integration.

**Science and Engineering Education (Head of Research Group: [Dr. Sherif Welsen](#))**

Research areas: Digital transformation in higher education, Online and blended learning, Future of the engineering education, Scholarship of teaching and learning, Development of engineering educators, Engaging undergraduate students in research, Student-centered learning environments, Data-driven engineering education, Lifelong learning in a changing world, Game-based learning and gamification for engineering education, Lab concepts (traditional, online, remote, pocket) in engineering education, University and industry/institutions and connections.