



Ali Labakhsh  
- completing a PhD in Engineering  
supervised by Professor Karunanayake Esselle

# Engineering

From research into wi-fi and robots to wearable antennas for medical applications and next-generation cellular systems, Macquarie's engineering researchers are uniquely positioned to help shape the complex issues that define the future of humanity.

We have research strengths in electromagnetic and antenna design, energy conversion and management, integrated wireless communication systems, nonlinear electronics, guided-wave optics and photonics, very-large-scale integration, and wireless communications and networking. We have a strong research program in mechanical engineering with an emphasis on medical devices and applications, while other researchers work on biomedical devices, biomedical imaging and mid-infrared photonics research.

In the most recent Excellence in Research for Australia evaluation, our research in electrical and electronic engineering received a rating of 'performance above world standard' and our research in biomedical engineering received a rating of 'performance at world standard'.

As a higher degree research candidate at Macquarie, you will have the opportunity to research alongside some of the world's best scholars whose cutting-edge research continually pushes the boundaries of knowledge. You will also benefit from our working partnerships with many of the global companies neighbouring our campus in Macquarie Park, Australia's largest high-tech precinct.

[mq.edu.au/research/engineering](http://mq.edu.au/research/engineering)



## AREAS OF SPECIALISATION

- Antennas and electromagnetics
- Biomechanics
- Communication system technologies
- Computational fluid dynamics
- Error-control coding
- Large-scale electronic system design
- Linear and nonlinear guided-wave optics and photonics
- Manufacturing and materials engineering
- Microelectronics and very-large-scale integrated circuit design
- Microfluidics
- Microwave and millimetre-wave circuits and devices
- Network performance analysis
- Power electronics
- Smart energy infrastructure
- Smart Sensor, WSN and IoT



**MACQUARIE**  
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## FACILITIES AND EQUIPMENT

- Ansoft high-frequency system simulators and mechanical design package
- ANSYS mechanical design software
- Automated antenna range in a shielded anechoic chamber
- Computational fluid dynamics simulation software
- CST Studio Suite for electromagnetic and microwave design
- Electronic and mechanical packaging facility
- Hardware accelerator for numerical simulations and computer-aided design
- Large-signal nonlinear network measurements – to 70 GHz
- Large-signal nonlinear spectrum analysis – to 70 GHz
- Mechanical testing
- Mentor Graphics IC nanometer design tools
- Millimetre-wave linear vector network analysis – to 150 GHz
- On-wafer device probing – Cascade probe station with thermal stage
- Parameter analysis and extraction software
- Pulsed network measurements (up to 5th order) – 1Hz to 10MHz
- Synopsys digital IC design tools and complete set of Xilinx FPGA platforms
- Two-tone active load-pull analysis – to 18 GHz
- Wind tunnel



## RESEARCH HUBS

- Biomedical Imaging and Sensing Group
- Centre for Electromagnetic and Antenna Engineering
- Collaborative Nonlinear Electronics Research Facility
- Concentration of Research Excellence in Wireless Communications
- Energy Research Group
- Guided Wave Optics and Photonics Research Group (with links to the MQ Photonics, MQ BioFocus and QSCITECH research centres)
- Macquarie University WiMed Research Centre
- Macquarie University VLSI Research Group
- Macquarie University Wireless Communications and Networking Laboratory



## RESEARCH PROJECTS

Higher degree research candidates have the opportunity to participate in a wide choice of research projects, including:

### MECHANICAL ENGINEERING

Computational and experimental fluid dynamics, microfluidics, development of advanced materials, mechanical design, thermal engineering, biomaterials and biomechanics. Projects in fuel cells, biosensors, bioimplants and bioimaging, and modelling of a wide range of fluid flow processes.

**E: [candace.lang@mq.edu.au](mailto:candace.lang@mq.edu.au)**

### OPTICAL AND PHOTONICS ENGINEERING

Integrated optics and optical fibres, mid-infrared sources and systems, microstructured and nanostructured materials. Projects in, and applications of, broadband optical fibre, guided-wave optical sensors, microwave photonics, highly efficient high-power compact fibre lasers and supercontinuum sources.

**E: [stuart.jackson@mq.edu.au](mailto:stuart.jackson@mq.edu.au)**

### BIOMEDICAL ENGINEERING

MR and other imaging, wireless and microfluidic implantable medical devices, biomaterials and biomechanics. Projects in novel radiation treatments, imaging and sensing, autonomously and wireless-controlled medical devices or wireless control.

**E: [yves.dedeene@mq.edu.au](mailto:yves.dedeene@mq.edu.au)**

### WSN, IOT AND TELECOMMUNICATIONS ENGINEERING

Theoretical and applied next-generation wireless, mobile and telecommunications, wireless sensor networks, Internet of Things, analog-mixed signal device modelling, RF to millimetre-wave circuit design and CAD/EDA, antenna design and modelling, signal processing, and communications algorithms and protocols.

**E: [subhas.mukhopadhyay@mq.edu.au](mailto:subhas.mukhopadhyay@mq.edu.au)**

### ELECTRICAL ENERGY ENGINEERING

Next-generation power electronics using wide bandgap semiconductors, energy management systems incorporating electric vehicles, solar-thermal energy and applications.

**E: [graham.town@mq.edu.au](mailto:graham.town@mq.edu.au)**

### COMPUTER ENGINEERING AND VLSI

Projects to improve hardware computation and architectures in very-large-scale integration structures, utilising visual processing and cryptography.

**E: [yinan.kong@mq.edu.au](mailto:yinan.kong@mq.edu.au)**

## OUR RESEARCH PRIORITIES

We pursue excellence in a broad range of research areas.

Our five interdisciplinary strategic research priorities – Healthy People, Innovative Technologies, Prosperous Economies, Resilient Societies and Secure Planet – respond to globally significant challenges and opportunities to improve the lives of millions.

Together, these research priorities provide a focal point for research, with discoveries made under these priorities translating into real improvements in the lives of local, national and global communities.

## JOINTLY SUPERVISED PHD PROGRAMS

Macquarie actively encourages cotutelles and joint degrees – shared supervision arrangements with universities whose research activity strongly aligns with ours. Under each model, you are enrolled at two universities with a principal supervisor at each and may be eligible for additional scholarship support.

**[mq.edu.au/cotutelle-and-joint-phd](http://mq.edu.au/cotutelle-and-joint-phd)**



### FIND OUT MORE

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