

Department	School of Engineering and the Built Environment
Supervisors	Petros Karadimas
Project Title	Compact MIMO antennas for 6G mobile devices

PROJECT DESCRIPTION

Antennas are the corner stone of wireless communications as they are responsible for transmitting and receiving the electromagnetic wave that carries the information message. Although a very classical topic with more than 100 years of history since the first wireless transmission, the design of optimum antennas remains a timely issue. Multiple input-multiple output (MIMO) communication systems have been employed to offer parallel data streams and increase data rate. Particularly, in future 6G mobile devices, such as mobile phones, tablets, vehicles' on-board units (OBUs), a compact antenna design should be integrated in the limited device space. Starting from a very thorough literature review, the PhD candidate will have to understand the radiation mechanisms of antennas and become familiar with the Maxwellian basis of antenna analysis and design. Accordingly, the PhD candidate will study existing MIMO antennas for mobile devices and evaluate them according to certain key performance metrics (KPMs) including the diversity antenna gain (DAG) and channel capacity (CC). The aforementioned step of studying and evaluating existing state-of-the-art MIMO antennas will enable the PhD candidate to gain significant experience to progress to the next level. That level and ultimate goal of this project is the PhD candidate to come up with novel brand new MIMO antenna designs (at least three) that will show better performance, i.e., higher DAG and CC, compared to the existing state-of-the-art designs.

Academic qualifications

A first degree (at least a 2.1) ideally in Electrical/Electronic/Communications Engineering with a good fundamental knowledge of Electromagnetic Theory and Fields, Microwave and mm-Wave Transmission Systems/Devices, Communication Principles, Engineering Mathematics, Vector Calculus.

English language requirement

IELTS score must be at least 6.5 (with not less than 6.0 in each of the four components). Other, equivalent qualifications will be accepted. [Full details of the University's policy](#) are available online.

Essential attributes:

- Experience of fundamental Electromagnetics and Electromagnetic Designs
- Competent in Electromagnetic wave propagation, Antennas, Antenna arrays
- Knowledge of Electromagnetic Theory and Fields, Microwave and mm-Wave Transmission Systems/Devices, Communication Principles, Engineering Mathematics, Vector Calculus
- Good written and oral communication skills
- Strong motivation, with evidence of independent research skills relevant to the project
- Good time management

Desirable attributes: Experience with Electromagnetic Simulation tools such as CST, HFSS.	
Indicative Bibliography	<ol style="list-style-type: none"> 1. Stutzman WL, Thiele GA. Antenna theory and design. John Wiley & Sons; 2012. 2. V. Papamichael and P. Karadimas, "On the Covariance Matrix and Diversity Performance Evaluation of Compact Multiport Antenna Systems," in <i>IEEE Transactions on Antennas and Propagation</i>, vol. 65, no. 11, pp. 6140-6144, Nov. 2017.
Enquiries	For informal enquiries about this PhD project, please contact Dr Petros Karadimas, email: p.karadimas@napier.ac.uk
Web page	https://www.napier.ac.uk/research-and-innovation/research-degrees/application-process