Department	School of Engineering and the Built Environment
Supervisors	Naser Ojaroudi Parchin and Chan Hwang See
Project Title	**Development of Programmable Metasurfaces for Smart Connectivity**

PROJECT DESCRIPTION

The future wireless networks are expected to constitute a distributed intelligent communications, sensing, and computing platform. Due to improved addressing solutions and extended services, new technologies such as "Programmable Metasurfaces" will be available to improve connectivity, monitoring, and smart sensing. The metasurface is an artificial ultrathin sheet with two-dimensional metamaterials arranged on a planar surface. Various functions such as beam shaping, concentrating, scattering, and focusing of the radiation can be achieved by optimizing the system. The main advantages of Metasurfaces with respect to the existing conventional technology include their low cost, low level of absorption, and ease of integration.

This project aims to develop new designs and driven techniques to improve the performances of the Programmable Metasurfaces to make them highly adaptable, multi-functional, and autonomous with low-cost and low complexity. The system will be characterized by a generic system-level simulation and multi-physics modelling software. This aspect covers the whole of the RIS development such as designing novel metamaterial unit cells with compact size, coding optimization and artificial intelligence analysis. The designs with better performances will be implemented and measured under different smart connectivity scenarios.

Academic qualifications

A first degree (at least a 2.1) ideally in Electrical or Computer Engineering with a good fundamental knowledge of Antennas.

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 Antennas and Metasurfaces.
- Competent in Signal Processing and CAD tools
- Knowledge of Microwave Engineering
- Good written and oral communication skills
- Strong motivation, with evidence of independent research skills relevant to the project
- Good time management

Desirable attributes:

Solid experience in RF circuits, metamaterials and antenna systems with a Track record of publishing in high-quality Journals and International Conferences.

Indicative Bibliography	[1] S. Luo et al., "Evolution of the Electromagnetic Manipulation: From Tunable to Programmable and Intelligent Metasurfaces," Micromachines, vol. 12, pp. 988, 2021. [2] J. Y. Dai et al., "Wireless Communication Based on Information Metasurfaces," in IEEE Transactions on Microwave Theory and Techniques, vol. 69, no. 3, pp. 1493-1510, March 2021. [3] B. Zheng et al., "Tunable Metasurface With Dynamic Amplitude and Phase Control," in IEEE Access, vol. 9, pp. 104522-104529, 2021.

	[4] S. Abadal, T. Cui, T. Low and J. Georgiou, "Programmable Metamaterials for Software-Defined Electromagnetic Control: Circuits, Systems, and Architectures," in IEEE Journal on Emerging and Selected Topics in Circuits and Systems, vol. 10, no. 1, pp. 6-19, March 2020.
Enquiries	For informal enquiries about this PhD project, please contact Dr Naser Ojaroudi Parchin, n.ojaroudiparchin@napier.ac.uk
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