Department	School of Engineering and the Built Environment
Supervisors	Naser Ojaroudi Parchin and Chan Hwang See
Project Title	**High-Efficiency Electromagnetic Energy Harvesting System with Reconfigurable Surfaces**

PROJECT DESCRIPTION

Wireless power transfer and electromagnetic energy harvesting have received considerable attention in recent years. The goal of energy harvesting is to convert the incident electromagnetic waves into useful and storable direct currents. One promising alternative to conventional systems that could uplift the energy harvesting and power transfer performance for future systems is the two-dimensional artificially engineered reconfigurable surfaces that exhibit spatial energy signal processing without requiring active phase shifters or amplifiers. Therefore, reconfigurable surfaces can facilitate efficient RF power transfer between points at a minimal cost. However, for long-distance energy transmission, it is essential to have a high-efficiency/high-gain harvesting system with beam-steering and reconfigurability properties.

The purpose of this PhD project is to design and develop a novel high-efficiency/low-loss energy harvesting system with reconfigurable surfaces. The system-level simulations and modeling will be used to characterize the proposed design. This aspect covers the whole process of the design development including high-efficiency rectifying circuits, low-cost reconfigurable surface, antenna system, optimisation and analysis. It will also involve prototyping and laboratory testing.

Academic qualifications

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

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 Microwaves
- Competent in Signal Processing and CAD tools
- Knowledge of RF Circuits
- 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, reconfigurable surfaces and antenna systems with a Track record of publishing in high-quality Journals and International Conferences.

Indicative Bibliography	[1] F. Erkmen, T. S. Almoneef and O. M. Ramahi, "Scalable Electromagnetic Energy Harvesting Using Frequency-Selective Surfaces," in IEEE Transactions on Microwave Theory and Techniques, vol. 66, no. 5, pp. 2433-2441, May 2018. [2] H. Ojukwu, B. -C. Seet and S. U. Rehman, "Metasurface-Aided Wireless Power Transfer and Energy Harvesting for Future Wireless Networks," in IEEE Access, vol. 10, pp. 52431-52450, 2022.

	[3] A. Ganti, T. Wynn and J. Lin, "A Novel Energy Harvesting Circuit for RF Surface Coils in the MRI System," in IEEE Transactions on Biomedical Circuits and Systems, vol. 15, no. 4, pp. 791-801, Aug. 2021. [4] M. Wagih and S. Beeby, "Thin Flexible RF Energy Harvesting Rectenna Surface With a Large Effective Aperture for Sub μW/cm2 Powering of Wireless Sensor Nodes," in IEEE Transactions on Microwave Theory and Techniques, vol. 70, no. 9, pp. 4328-4338, Sept. 2022.
Enquiries	For informal enquiries about this PhD project, please contact Dr Naser Ojaroudi Parchin, n.ojaroudiparchin@napier.ac.uk
Web page	https://www.napier.ac.uk/research-and-innovation/research-degrees/application-process