



PhD Studentship:

**Smart Infrastructure Exploiting Backscatter
Communications**

Microwaves and Antenna Engineering Group

<https://microwaves.site.hw.ac.uk>

Institute for Infrastructure & Environment

PhD Studentship

In Microwave and Antenna Engineering Group
Heriot-Watt University, Edinburgh, Scotland, UK, EH14 4AS

Smart Infrastructure Exploiting Backscatter Communications

Project Description

The K-Briq, a world-first sustainable brick made almost entirely of construction waste, has demonstrated the great potential to transform the construction industry. This novel brick from Kenoteq (<https://kenoteq.com/>), a spin-out startup from Heriot-Watt University, has been highly recognised, such as receiving Design and Creativity Award (Converge Challenge) in 2018 and Times Higher Education Award (STEM Research Project of the Year) in 2020.

The proposed research project aims to push the sustainability to a next level, i.e., not only sustainability in terms of brick fabrication, but also sustainability to the every-day operation of the buildings that are constructed with the K-Briq. This will be enabled by embedding sensors into bricks, and they, after being laid into a building, can establish a wireless network to sense and assist building operation. That embedding into bricks means that the sensing nodes have to be maintenance-free, i.e., no external power sources like batteries can be relied on. The research team will further develop high-efficiency RF energy harvesting and backscattering wireless communication technologies [1] to enable power autonomy to the nodes and reliable wireless link establishment.

Duration: 42 Months

Scholarship: £18,360 annual stipend plus tuition fees waived

Deadline: as soon as possible

Supervision Team:

To apply please send your motivation letter, CV, and recommendation letters (optional) to yuan.ding@hw.ac.uk.

Dr Yuan Ding with expertise in Microwave Engineering and Backscattering Communications will work with the student on sensing node design and backscattering communication link optimisation (<https://yding04.wordpress.com/>);

Prof. Gabriela Medero will guide the student on K-Briq fabrication process and property analysis, and she will act as the interface to the support offered by Kenoteq;

Dr Chaoyun Song with expertise in RF energy harvesting will provide contribution on node power autonomy.

Candidate:

MSc degree or equivalent in electrical engineering with a focus on RF/microwave engineering, electromagnetics, antenna theory, and communication theory.

Further information on [English language requirements for EU/Overseas applicants](#).

Funding Notes:

All students including UK, EU and overseas are eligible to apply for this position covering tuition fees and stipend.

Relevant References:

[1] Chaoyun Song, Yuan Ding, Aline Eid, Jimmy Hester, Tony He, Ryan Bahr, Apostolos Georgiadis, George Goussetis, and Manos Tentzeris, "Advances in wirelessly powered backscatter communications: From antenna/RF circuitry design to printed flexible electronics," IEEE Proc., vol. 110, no. 1, pp. 171–192, Jan. 2022. DOI: 10.1109/JPROC.2021.3125285

[2] Romwald Lihakanga, Yuan Ding, Gabriela M. Medero, Samuel Chapman, and George Goussetis, "A high-resolution open-source platform for building envelope thermal performance assessment using a wireless sensor network," Sensors, vol. 20, no. 1755, 2020. DOI: 10.3390/s20061755

[3] Ronnie Smith, Yuan Ding, George Goussetis, and Mauro Dragone, A COTS (UHF) RFID floor for device-free ambient assisted living monitoring, book chapter for Springer Book 'Advances in Intelligent Systems and Computing', pp. 127–136, 2020. ISSN: 2194-5357