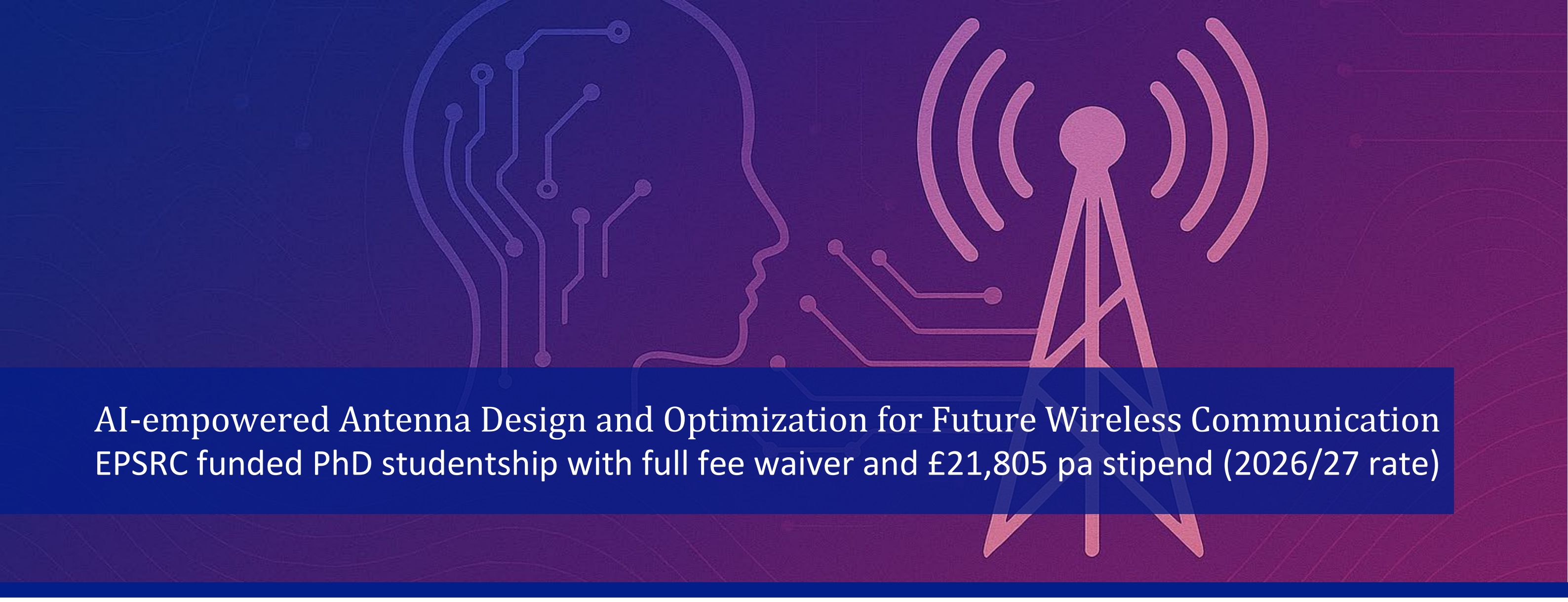

AI-empowered Antenna Design and Optimization for Future Wireless Communication

EPSRC funded PhD studentship with full fee waiver and £21,805 pa stipend (2026/27 rate)

Project Code: DLA_DTP_2026_14

Main Supervisor: Dr Qiang Hua

Co-Supervisor: Dr Dang Khoa Hoang, Professor Pavlos Laziridis

Project Introduction

Future 6G and beyond wireless systems require antennas that are compact, wideband, energy-efficient, and robust to packaging, user interaction, and manufacturing tolerances. Conventional electromagnetic (EM) optimisation is increasingly limited by high-dimensional design spaces and the heavy cost of full-wave simulation. This project will develop an AI-empowered, physics-guided antenna design pipeline combining multi-fidelity EM modelling, active learning, and uncertainty-aware multi-objective optimisation. The research will deliver validated design methods and prototype antennas that reduce design time and compute cost while improving performance and reliability for next-generation wireless communications.

Project Details

This project will develop an AI-empowered antenna design and optimisation framework that enables rapid, reliable synthesis of antennas for future wireless communication (e.g., sub-6 GHz, mmWave, and emerging 6G use cases). Modern antenna requirements—wide bandwidth, high efficiency, compact form factor, MIMO isolation, and robustness to packaging and user/environment effects—create high-dimensional, multi-objective design problems where conventional full-wave EM optimisation is slow and often difficult to generalise across platforms.

The research will deliver a physics-guided, uncertainty-aware workflow that reduces the number of expensive high-fidelity simulations while improving design robustness. The core approach combines: (i) multi-fidelity EM modelling (fast approximate simulations and higher-accuracy full-wave solvers), (ii) data-efficient surrogate modelling (e.g., Bayesian or probabilistic neural surrogates) to predict performance across frequency and geometry, (iii) active learning to select the most informative new simulation samples, and (iv) robust multi-objective optimisation that accounts for manufacturing tolerances and deployment variability. Physics priors (e.g., constraints reflecting passivity/causality, symmetry, bounded responses) and calibration techniques will be used to improve model reliability and reduce "black-box" failure modes.

The project will be demonstrated on two representative antenna case studies, for example: (1) a compact wideband single-element antenna for handset/IoT platforms, and (2) a small MIMO subsystem (or array element) where isolation and efficiency trade-offs are critical. For each case study, the pipeline will produce Pareto-optimal designs and quantify confidence/robustness under realistic perturbations (material tolerances, dimensional errors, nearby objects). At least one final design will be fabricated and experimentally validated (S-parameters and, where feasible, radiation characteristics), closing the loop between simulation, AI prediction, and measurement.

By the end of three years, the project will deliver: (a) a validated AI-driven optimisation pipeline with documented best practices for antenna designers, (b) curated datasets and reproducible code to support future research, (c) at least one prototype with measured agreement to predicted performance, and (d) publishable methodological contributions in data-efficient EM optimisation and uncertainty-aware design.

Timeline: Year 1—define case studies, build simulation data pipeline, baseline optimisers, initial surrogate models. Year 2—multi-fidelity learning and active learning; uncertainty calibration; robust optimisation. Year 3—prototype fabrication/measurement, refinement, final evaluation, and thesis write-up integrated throughout the year.

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Project-specific entry requirements

Eligible for UK Home fee status & satisfy EPSRC/UKRI residency requirements. Expected to have (or be close to completing) a first-class or strong upper second-class (2:1) UK honours degree, or equivalent, in Electrical/Electronic Engineering, Communications Engineering, Physics, Computer Science, Applied Mathematics, or closely related discipline. A relevant Master's degree (e.g., MSc/MEng) is desirable but not essential for exceptional candidates.

Essential: Solid fundamentals in electromagnetics &/or RF engineering, including transmission lines, S-parameters, antenna basics, & frequency-domain analysis. Strong mathematical & analytical ability (linear algebra, optimisation concepts, numerical methods). Programming proficiency in Python &/or MATLAB, including handling datasets & implementing algorithms. Ability to work independently, manage time effectively, & communicate technical work clearly in written and spoken English.

Desirable: Experience with EM simulation tools (CST, HFSS, FEKO, COMSOL, open-source solvers) & parametric modelling. Understanding of machine learning concepts (supervised learning, regression, model validation) &/or Bayesian optimisation/active learning. Familiarity with multi-objective optimisation & engineering constraints (tolerances, manufacturability). Practical lab experience with RF measurement (VNA measurements, antenna pattern/efficiency testing) & basic prototyping (PCB, 3D printing, soldering). Evidence of research potential (final-year project, publications, competitions, internships, relevant industry experience). Motivated to work at interface of AI and RF/antenna engineering, with strong interest in delivering reproducible research & experimentally validated outcomes within 3-year PhD timeframe.

Further Information

This call is open to **UK Applicants only**. Applicants should be of outstanding quality and exceptionally motivated.

Studentships are funded for 3 years (subject to satisfactory annual performance/ progression review) & will provide for tuition fees and a tax-free stipend paid monthly.

Please note there are more projects than funded studentships available & therefore this is a competitive application process which will include an interview. Shortlisted candidates will be contacted for interview & the most outstanding applicants will be offered a studentship.

Queries about the application process are welcome and should be emailed to pgrscholarships@hud.ac.uk.

Informal enquiries about this project should be directed to Dr Qiang Hua.

Type of Award: Doctor of Philosophy (PhD).

Eligibility: UK applicants only. First Class or Upper Second-Class Honours degree or equivalent in a relevant subject area, please refer to the entry requirements on the specific projects being advertised.

Location: Huddersfield.

Funding: 3 years full time research covering tuition fees and tax-free bursary (stipend) starting at £21,805 for 2026/27 & increasing in line with the EPSRC guidelines for subsequent years. Funded via the Engineering & Physical Sciences Research Council Doctoral Training Programme.

Duration: 3 years full-time plus 12 months writing up (please note no funding available for writing up period).

Closing date: 28th April 2026

Start date: 1st October 2026

Application details

- Go to the EPSRC webpage and download the Expression of Interest Form 2026.
- Provide copies of transcripts & certificates of all relevant academic and professional qualifications.
- Provide references from two individuals – please contact your referees and ask them to send them directly to pgrscholarships@hud.ac.uk from their email address.
- Proof of eligibility – e.g. scan of passport photo page.
- Completed forms, including all relevant documents should be submitted via-email to pgrscholarships@hud.ac.uk.

Please note: if you do not attach all the relevant documentation prior to the closing date your application will not be considered.

University of Huddersfield
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