Holistic Design Optimisation of Power Electronic Converters for Electric Vehicle (EV) Applications

**Type of award**  
PhD Research Studentship

**Department**  
Electrical Energy Management Group

**Scholarship Details**  
Minimum £17,668 p.a. subject to eligibility status and confirmation of award.

**Duration**  
3.5 years

**Eligibility**  
Home/EU (UK settled status) with permanent UK residency

**Start Date**  
From September 2022

**PhD Topic Background/Description**

Due to the climate emergency, the UK government has committed to net zero carbon by 2050, ending the sale of new petrol and diesel vehicles by 2030 and all new cars and vans fully zero emission from 2035. As a result, the automotive industry is investing in electric vehicles (EVs) and its key enabling technologies, power electronics, machines and drives. For EVs to be a viable option in the automotive market, the power electronic converter needs to be as small and light as possible to maximise the vehicle’s power to weight ratio and extend its range between charges so that it is competitive with petrol and diesel.

However, to create converters with high power densities, the design process must account for the electrical, mechanical and thermal aspects simultaneously to meet all the design specifications. Development of automated holistic, software-based design tools are therefore essential to reaching this goal and pushing the limits of what can be achieved in power electronics design.

This project will develop a multi-domain automated software tool that optimises the volume of a power electronic converter utilising wide-bandgap devices for an EV application. The tool will compare the electrical and thermal characteristics of a wide range of component combinations to determine the specific combination that produces the highest power density whilst meeting the converter’s performance and efficiency specifications. It will involve electrical and thermal modelling; software development; and hardware construction in order to produce state-of-the-art converters.

A PhD study offers a unique opportunity to develop in-depth skills and knowledge that will provide a springboard for further career progression. You will be part of the Bristol Electrical Energy Management (EEMG) research group (bristol.ac.uk/engineering/research/em/), a multi-disciplinary team of academic researchers at the University of Bristol. EEMG have extensive expertise in power electronics modelling, design, and manufacture.
**Further Particulars**

**Candidate Requirements**
Applicants must hold/achieve a minimum of a Masters degree (or international equivalent) in Electrical or Electronic Engineering or a related discipline and with knowledge of Power Electronics or Electronic Devices. Applicants without a Masters qualification may be considered on an exceptional basis, provided they hold a first-class undergraduate degree. Please note, acceptance will also depend on evidence of readiness to pursue a research degree.

Basic skills and knowledge required:

- **Essential:** Excellent analytical skills and experimental acumen
- **Desirable:** A background or basic understanding in one or more of the following.
  - Power electronic devices and topologies
  - SPICE-based circuit simulation or similar
  - Circuit design and construction including component selection, PCB design and soldering skills
  - Programming skills (MATLAB, C/C++)

**Scholarship Details**
Stipend at the UKRI minimum stipend level will also cover tuition fees at the UK student rate. Funding is subject to eligibility status and confirmation of award.

To be treated as a home student, candidates must meet one of these criteria:

- be a UK national (meeting residency requirements)
- have settled status
- have pre-settled status (meeting residency requirements)
- have indefinite leave to remain or enter.

It may be possible to fund an international fee status as part of the EPSRC’s open eligibility allocation. You should be aware that there is typically strong competition within the university to make use of this flexibility.

**Informal enquiries**
For questions about the research topic please contact Dr Ian Laird at Ian.Laird@bristol.ac.uk

For questions about eligibility and the application process please contact SCEEM Postgraduate Research Admissions sceem-pgr-admissions@bristol.ac.uk

**Application Details**
Prior to submitting your application, please contact the academic listed to discuss your research proposal and see if it aligns with their current research. No indication of an offer can be made until we receive your completed application.

To apply for this studentship, submit a PhD application using our online application system [www.bristol.ac.uk/pg-howtoapply]

Please ensure that in the Funding section you tick “I would like to be considered for a funding award from the Electrical Engineering Department” and specify the title of the studentship in the ‘free text’ box below along with the name of the supervisor. Interested candidates should apply as soon as possible.