

Title: PhD in Advanced Integrated Motor Drive technologies

We have an exciting PhD opportunity in Power Electronics, Machines and Drives (PEMD), in collaboration with two other leading UK academic institutions, to develop sustainable and high power density Integrated Motor Drive (IMD) technologies. The resulting advances will underpin the step change in performance needed by industry to resolve recognized barriers to adoption of low carbon technologies in a broad range of sectors including aerospace, automotive, and energy.

Context: When traditionally separated motor drives are integrated together into a single package, as shown in fig.1, significant improvements in power densities (kW/kg) can be achieved through sharing of enclosures and cooling systems as well as indirectly by unlocking additional design freedoms [1]. Combined with recent advances in state-of-the-art semiconductor devices and advanced manufacturing techniques, such as Additive Manufacturing, ultra-efficient and compact IMDs can be created. With the ongoing drive to reduce carbon emissions globally, IMDs are a key enabling technology in myriad applications, including electrical propulsion systems for aircraft and higher power and reliability wind turbines for energy generation.

Due to the extreme environments encountered by components in IMDs, multidisciplinary challenges span both mechanical and electrical domains, which need to be addressed before their widespread adoption can be achieved. This PhD opportunity will see development of experimental hardware to evaluate state-of-the-art semiconductor devices and components for their suitability in high-performance IMDs.

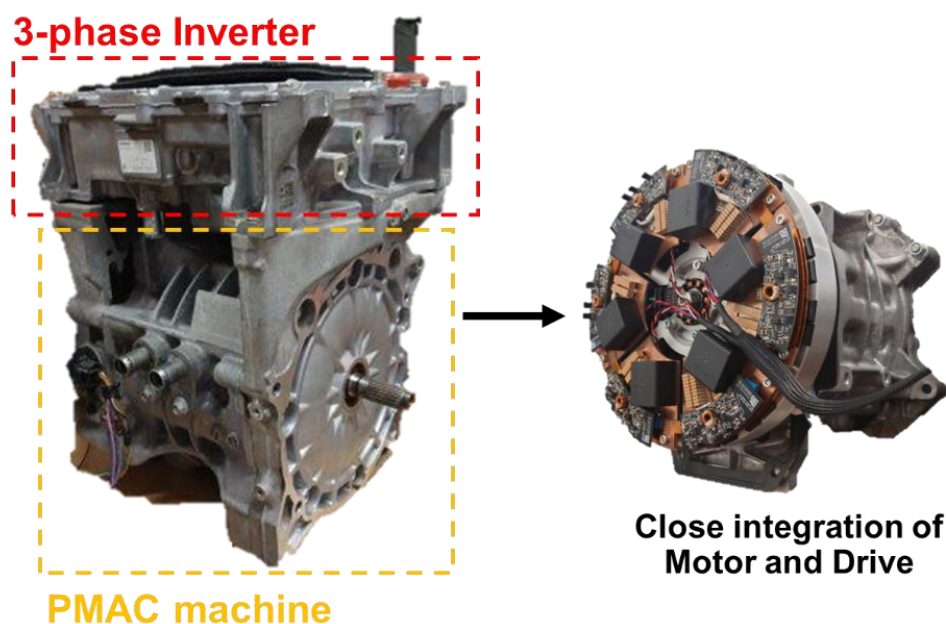


Figure 1: UoB IMD based on an 80kW Nissan Leaf PMAC machine with close integration of power electronics and electrical machine.

[1] T. M. Jahns and H. Dai, "The past, present, and future of power electronics integration technology in motor drives," in *CPSS Transactions on Power Electronics and Applications*, vol. 2, no. 3, pp. 197-216, Sept. 2017

What will I be doing?

The successful candidate will join the project team under a multi-disciplinary supervisory team who will provide training and project supervision. Example activities (to be refined as the project progresses) include:

1. Learning relevant underpinning multi-disciplinary concepts, and application context.
2. In-depth literature review and IMD technology mapping.
3. Development of simulation models and analytical methods for identifying and assessing components suitable for IMD applications.
4. Construction of an experimental hardware platform for evaluating electro-thermal properties of active and passive power electronic components.
5. Undertake component and system level characterisation and experimental testing for simulation model validation and developing data to be shared with project partners for informing concept IMD demonstrators.
6. Collaboration with the academic and industrial project partners, including opportunities for cross-site placements.
7. Regular dissemination of findings via internal and external meetings and events.
8. Publication of findings at appropriate international conferences and in journal proceedings e.g. IEEE Energy Conversion Congress and Expo (ECCE) typically held in North America/Canada.
9. Play an active role in the research group community for your own development and development of others.

Should I apply?

You should apply if you are a motivated, collaborative engineering graduate at 2:1 or above with a desire to apply your background to highly multi-disciplinary problems with real world impact potential in stepping toward Carbon Net Zero. The successful applicant will have the opportunity to work in a highly multi-disciplinary multi-institutional team, undertake direct work with academic and industrial project partners, including placements, and present research at international conferences and project update meetings.

Closing Date: 5th December 2025 – contact Dr. Hopkins and Dr. Simpson to discuss before this date.

Earliest start date: Nominally September 2026 but with the possibility to start sooner

Funding: £20,780 p.a. for 3.5 years subject to eligibility status and confirmation of award

Eligibility: To be eligible for a full award the student must have no restrictions on how long they can stay in the UK and have been ordinarily a resident in the UK for at least 3 years prior to the start of the studentship (with some further constraint regarding residence for education). To be considered for funding Candidates must:

- Be a UK National (meeting residency requirements)
- (or) Have settled status
- (or) Have pre-settled status (meeting residency requirements)

- (or) Have indefinite leave to remain or enter.

Further Information:

<https://ukerc.rl.ac.uk/cgi-bin/ercri4.pl?GChoose=gdets&GRN=EP/Z536295/1>

<https://www.bristol.ac.uk/news/2025/april/sustainable-electrification-grant.html>

How to apply: If you meet the eligibility criteria, please direct enquiries to Dr. Andrew Hopkins (Andrew.hopkins@bristol.ac.uk) and Dr. Nick Simpson (nick.simpson@bristol.ac.uk) in the first instance.