

Title: Smart Automated Composites Manufacture

Type of award PhD Research Studentship

Department Aerospace Engineering, Bristol Composites Institute

*Scholarship
Details* Minimum £20,500 p.a. subject to eligibility and award

Duration 3.5 years

Eligibility Home (UK) and EU citizens who have confirmation of UK settlement or pre-settlement status under the EU Settlement Scheme and Overseas

Start Date Anytime from October 2022 to March 2023

PhD Topic Background/Description

The development of future generations of composite structures requires making better use of in-process data to improve composite part quality and reduce energy use and manufacturing waste. Our aim is to **develop smart automated composites manufacturing process that act on in-process data to correct imperfections before they evolve into defects that require more drastic measures.**

Composite structures that will play a leading role in future lightweight aircraft (e.g. commercial passenger flight and advanced air mobility), renewable energy (e.g. wind power generation), and the hydrogen economy (e.g. tanks for hydrogen storage and transportation). Manufacturing curved shapes requires forcing very stiff and straight fibres to bend along a path which can lead to imperfections, which if left uncorrected, will degrade their excellent mechanical properties. To avoid repair, re-work or scrapping of newly made composite structures, they are overdesigned to accommodate a high number of defects. Existing manufacturing research employs in-line sensing to detect and manually remove imperfections at the point of application. One significant research challenge is to automatically correct the imperfection to avoid wasting high-value carbon fibre that cannot currently be recycled. In this project, we will track the evolution of imperfections through the manufacturing cycle to quantify the influence on the final performance.

A highly instrumented automated manufacturing machine will be used with eddy-current sensors to measure the quality of each composite layer as it is deposited. Partially and fully consolidated composite parts will be evaluated by microscope and X-ray CT scanning. Attention to detail will be required during data collection, fusion, analysis, and interpretation. Ultimately, a digital twin of the “as-manufactured” physical part will be created, resulting in a much smarter manufacturing process. One research direction is to explore the role of machine learning to interpret machine information in real-time and feedback into the control of the manufacturing hardware.

The successful candidate will be based at the Bristol Composites Institute and the Ultrasonics and Non-Destructive Testing research groups, two world-leading research centres at the heart of the UK Government Strategy. The researcher will have access to state-of-the art equipment, opportunities to engage with industry, and the chance to work with leaders in the field.

Candidate Requirements

Applicants must hold/achieve a minimum of a master's degree (or international equivalent) in a science, mathematics, or engineering discipline. Applicants without a master's 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.

If English is not your first language, you need to meet this profile level:

Profile E

Further information about [English language requirements and profile levels](#).

We are looking for a talented, enthusiastic researcher to join our team and carry out research into the fascinating overlap between advanced composite manufacturing, non-destructive testing, and digital technologies. They will have a good understanding of engineering, and a desire to learn new skills and methods. They will contribute their own ideas, communicate their research to others and be enthusiastic about creating something new, interesting, and useful in their work.

Scholarship Details

For eligibility and residence requirements please check the [UKRI UK Research and Innovation](#) website.

Informal enquiries

For questions about the **research** topic, please contact [Dr James Kratz](#) and [Dr Robert Hughes](#)

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

Application Details

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 **Aerospace Engineering** Department" and specify the title of the scholarship in the "other" box below with the name of the supervisor.

Closing date for applications: **5 September 2022**