

Title: Effect of laminate architecture on the fatigue life of composite structures subjected to multiaxial loading

Type of award PhD Research Studentship

Department Bristol Composites Institute, Aerospace Engineering

Scholarship Details Minimum £15,285 p.a. subject to eligibility criteria and award

Duration 4 years

Eligibility Home/EU

Start Date From April 2021

PhD Topic Background/Description

Accurate fatigue life models enable the light-weighting of composite structures and improvement of service life predictions, making them more cost-effective and sustainable.

Most fatigue life models are informed by simple uniaxial experimental data. Though composite structures are known to undergo multiaxial in-service loading, the models are not generally well-validated against multiaxial test data. This is due to the challenges associated with conducting multiaxial fatigue experiments and their interpretation. In addition to this, many models have been developed on specific material systems and their applicability to other material configurations is generally not well-assessed. This restricts their usefulness in the design and validation of composite structures and inhibits the exploration of new material and structural concepts with improved fatigue life.

The aim of the project is to develop a novel experimental methodology based on a new multiaxial test rig – the modified Arcan fixture (MAF) – to assess the multiaxial fatigue performance of composite laminates. To monitor the internal damage evolution during fatigue testing, the method may combine a range of experimental techniques such as digital image correlation (DIC), infrared thermography (IRT), and X-ray computed tomography (CT). It is envisaged that the developed procedures will be applied in the investigation of different laminates to understand the effect of changing design features such as the lay-up and stacking sequence. The high-fidelity experimental data will then be used to challenge existing fatigue life models and to inform and develop next generation modelling frameworks. The combined experimental and numerical data can then be further used to characterise the role of laminate architecture on fatigue life performance.

Preliminary project outline:

Year 1: Obtaining quasi-static experimental data for a range of composite laminates and upgrading the existing MAF for fatigue testing.

Year 2: Developing experimental procedures for multiaxial fatigue testing and obtaining test data for a range of composite laminates.

Year 3: Developing/validating models to predict the multiaxial fatigue life and developing guidelines for design.

The project aligns with the EPSRC Programme Grant “CerTest” that is supported by several companies and technology transfer institutions in the UK aerospace industry. URL for further information: www.composites-certtest.com

Candidate Requirements

Applicants must hold/achieve a minimum of a 2:1 MEng, MPhys or an MSc (or international equivalent) in a physics or engineering discipline with a preference for mechanics.

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](#).

Basic skills and knowledge required

Solid and computational mechanics, mechanics of composite materials, experimental mechanics. Experience in the basic mechanics of composite materials is essential. Experience of using tools such as MATLAB, Python, FEA, and advanced experimental techniques such as digital image correlation (DIC) is highly desirable. Perspective students will develop a broad, holistic understanding of composite mechanics, and will acquire new expertise in mechanical testing, imaging and modelling.

Informal enquiries

Please email Prof Janice Barton (janice.barton@bristol.ac.uk), Prof Ole Thomsen (o.thomsen@bristol.ac.uk)

For general enquiries, please email 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: 31 May 2021

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