

## **Title: Improved design of lightweight composite sandwich structures through integrated high-fidelity modelling and experimental characterisation**

*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/Overseas

*Start Date* From April 2021

### **PhD Topic Background/Description**

#### Background and motivation:

Lightweight composite sandwich structures have gained widespread use spanning multiple areas of applications including aerospace, transportation, and wind and tidal turbine blades. Whilst structurally efficient, there are still several scientific and technical challenges that have yet to be fully resolved. The project aims to examine the load response and failure behaviour of lightweight CFRP (carbon reinforced plastic) face sandwich structures subjected to localised and high gradient stress and strain conditions. These occur in the vicinity of geometric/material discontinuities like e.g. face sheet ply-drops, transitions between sandwich and monolithic type structural layouts, core inserts, changes of core stiffness and structural joints. The project will investigate localised effects that can induce damage initiation/progression, most severely in the form of delamination/debonding between face sheets and core material, and unstable and very rapid delamination growth can occur without prewarning.

#### Project aims and objectives:

The project will develop an improved and quantitative understanding of the load response and failure behaviour of CFRP face sheet sandwich structures through the integration of high-fidelity experimental methods based on imaging and multi-scale computational modelling. In parallel the project aims to develop a means of significantly improving the damage tolerance of sandwich structures by tailoring the core geometry and the face sheet core interfaces.

The expected outcomes/deliverables of the PhD project are:

1. A multi-scale modelling framework for the prediction of the load response and progressive damage and failure behaviour of CFRP sandwich structures.

2. A high-fidelity experimental methodology combining imaging approaches applied to data-rich characterisation of the load response and progressive damage and failure behaviour of CFRP sandwich structures.
3. A methodology for integration of multi-scale computational model predictions and full-field imaging based physical (experimental) data through data fusion.
4. A design concept to achieve CFRP sandwich structures with improved damage tolerance.

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](http://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, advanced experimental techniques including full field imaging. Experience in the basic mechanics of composite materials e.g. classical laminate theory is essential. Experience of using tools such as MATLAB, Python and FEA is highly desirable. During the project, these skills will be developed and enhanced. The project will develop new expertise in mechanical testing, imaging, and modelling

### Informal enquiries

Please email Prof Ole Thomsen ([o.thomsen@bristol.ac.uk](mailto:o.thomsen@bristol.ac.uk))

For general enquiries, please email [came-pgr-admissions@bristol.ac.uk](mailto: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](http://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:** 1 March 2021

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