Title: Full-field imaging approaches for assessment of subsurface defects in composite structures

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

The project involves two full-field imaging approaches: Thermoelastic Stress Analysis (TSA) and Digital Image Correlation (DIC). TSA utilizes Infrared Thermography (IRT) and delivers a stress metric, based on a surface temperature change that occurs as a component is loaded. DIC delivers the displacements and in-plane surface strains. In fibre reinforced polymer composite materials defects occur internally because of manufacturing. Likewise, internal features are introduced in composite structures because of the component design. The aim of the PhD is to combine the two approaches to reveal information about the stresses in the vicinity of an internal defect or feature to enable an assessment of the severity of the defect and the effect it will have on the structural performance. The idea of obtaining the internal stresses using the two techniques is completely new and leads to the research question the PhD project will address: “can the two established surface measurement techniques be combine to provide a subsurface measurement?”. The research proposition is that as the defects and features cause stress concentrations, ‘hot spots’ that generate heat transfer will occur and these will contribute to the surface temperature measurement. To extract the subsurface stresses from the overall surface temperature measurement it is proposed to use DIC, which is independent of the sub-surface strains.

The project is challenging and ambitious, it will require extensive use of models to predict the heat transfer, which will be combined with the experimental data. The vision is to create a tomographic view the subsurface stresses where the loading frequency is tuned to obtain information at different depths. An outline time plan is as follows:

Year 1: Combining DIC and TSA and application to a structural component.

Year 2: Developing thermomechanical models to predict the thermoelastic response over a range of frequencies.

Year 3: Application of combined DIC and TSA to extract subsurface stresses in composite structural components.

Year 4: Implementing the approach in an industrial setting.

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-certest.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
The project is experimental it will involve design, manufacture, and test of composite components. Knowledge of mechanics, thermodynamics especially heat transfer is required 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 Janice Barton (janice.barton@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 Mechanical 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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