QUB- Mechanical and Aerospace Engineering PhD Project 2017-2018

Robust optimisation for the design of crashworthy composite transportation structures

Project Description:

The latest generation of 'all-composite' wide-body passenger aircraft has brought to the fore the need to ensure a level of crashworthiness commensurate with that of similarly-sized metallic aircraft. Even though there are no aircraft-level survivable crash conditions specified in airworthiness regulations, experience has shown that there is a high probability of occupant survivability within certain impact parameters for metallic aircraft and that a similar level of safety should be expected of composite aerostructures. As the automotive industry transitions to the use of lightweight composite materials in mass-produced vehicles, to meet increasingly strict emission guidelines, the issue of crashworthiness is arguably of even greater importance. To date, even high-end road vehicles with carbon-fibre composite passenger cells resort to metallic elements for their primary energy absorbing capability.

It is often claimed that carbon-fibre composites have higher specific energy absorption than steel and aluminium but this is not an intrinsic material property. Composites will deliver superior energy absorption provided that structural elements are designed to fail in a manner which maximises energy dissipation.

The aim of this research project is to develop a robust optimisation framework which exploits a sophisticated computational damage model, developed by the lead supervisor's research group. This will allow for the design of highly energy-absorbing composite transportation structures which will be effective across a spectrum of crash event scenarios.

Advanced Composites Research Group

Key Skills Required for the post:
Candidate should demonstrate knowledge/experience/skills in at least one of the following areas:

- Fibre reinforced composites
- Numerical modelling (primarily finite element analysis)
- Fracture and/or damage mechanics
- Stochastic analysis (desirable)

Key Transferable Skills that will be developed during the PhD:
These will include an ability to effectively communicate research outcomes to academic peers and industry, independent analytical thinking and problem solving, time management, and leadership.

First/Lead Supervisor and their contact details	Prof Brian G. Falzon FRAeS Royal Academy of Engineering – Bombardier Chair in Aerospace Composites b.falzon@qub.ac.uk
Second Supervisor and their contact details:	Dr Mukul Shukla m.shukla@qub.ac.uk
Top up available for this project?	The studentship covers the full university fees and includes an income of up to £18,500 per annum (comprising a £14,000 stipend, a potential £3,000 top-up and the opportunity to undertake teaching and demonstration duties to earn a further £1,500 per annum). The top-up is available, dependent on the recommendation of the interview panel **[UK residents only]**

Queens University Belfast is a diverse and international institution which is strongly committed to equality and diversity, and to selection on merit. Currently women are under-represented in research positions in the School and accordingly applications from women are particularly welcome.