QUB - Mechanical and Aerospace Engineering
PhD Project Description

Title: Bio-Inspired Aircraft Design Enabled through Advanced Manufacturing Processes

Theme: Future Aircraft, Advanced Manufacturing and Processing

Project description:

Birds represent a near perfect optimization of flying and flight. Attempts to technologically recreate the optimal flying solutions presented in nature, however, have long fallen short. Unable to meet the strength-to-weight and power-to-weight ratios that enables bird flight, or to mimic the flexibility of wings that provide efficient avian aerodynamics, aircraft designers turned their attention to fixed, non-flexible wing designs, along with structural and manufacturing concepts to support them. These tube and wing designs have long dominated aircraft design, and the aircraft design methods that generate them are now considered traditional.

Recent advances, however, in composite materials and innovative manufacturing methods, such as additive manufacturing (3D printing) have the potential to fundamentally change how aircraft are designed, and opens the design space to strive for bio-inspired optimal solutions. This project asks the fundamental question: ***can advanced manufacturing methods change the way we design aircraft?*** The answer to this question goes beyond a one-off point optimization of a bespoke design, but rather explores how the ***process*** of aircraft design fundamentally changes in response to new manufacturing methods and their associated new materials. This potentially enables the realistic and consistent design of bio-inspired aircraft.

Blue Bear's iMorph concept

Airbus 'Bird of Prey' concept

Aims and Objectives:

Develop a thorough understanding of traditional aircraft design methods and how they map to modern and legacy aircraft configurations

Identify and articulate how advanced manufacturing methods, including additive manufacturing, enable the consideration and integration of bio-inspired optimal structural and aerodynamic concepts that do not result from traditional aircraft design methods

Propose and demonstrate how an aircraft design space changes as a result of advanced manufacturing methods

Define and validate novel aircraft design strategies that enable the design and manufacture of bio-inspired optimal flight concepts.

Key skills required for the post: knowledge of engineering design, particularly aerospace design; systems engineering, modelling and simulation	
Key transferable skills that will be developed during the PhD: Research and analytical skills, problem solving and data analysis, technical communication, information technology, personal development	
Lead supervisor:	Dr. Dani Soban
Other supervisor(s):	Dr. Joe Butterfield
Funding mechanism:	Yet to be secured
Application closing date:	
Guaranteed stipend:	Base stipend for 19/20 is £15,009.
Conditional top-up available:	Conditional upon funding
PhD students in the School may have the opportunity to apply to be demonstrators on undergraduate modules. Compensation for this can amount to in excess of £2,400 per year.	

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.