Title: Aircraft Active Inceptor Dynamics under Vibration Loads

Type of award	PhD Research Studentship
Department	Aerospace Engineering
Scholarship Details	Scholarship covers full UK PhD tuition fees and a **tax-free** stipend at the RCUK rate (£14,553 in 2017/18). This scholarship also includes a further £3.5k p.a. 'top-up' in addition to the basic stipend.
Duration	4 years
Eligibility	UK applicants only
Start Date	1 October 2017

PhD Topic Background/Description

An EPSRC Industrial CASE award PhD studentship is available at the University of Bristol in collaboration with BAE Systems. The candidate will interact closely with experts at BAE Systems in Rochester, including one or more placements within the company. There is a strong possibility that BAE Systems may be able to offer the candidate a position following the successful PhD, or there could potentially be scope for follow-on post-doctoral research.

Aircraft with fly-by-wire control systems often incorporate so-called active inceptors (stick, throttle, pedals, etc.) that provide the interface between the pilot and the aircraft control surfaces. These devices are complex electro-mechanical gimbal systems utilising motors, servo-actuators, torsional springs, linear springs, ball bearings, spherical bearings and displacement and force transducers – all interconnected via a series of mechanical linkages and a pilot's grip assembly. The system controls the grip force-to-displacement relationship to allow real time variation in feel characteristics to support aircraft operational modes.

The dynamic response of the individual elements in an inceptor, and of the system as a whole, is critical in maintaining the level of performance required throughout its service life. Whilst the fatigue life is partly driven by the pilot-applied cyclic loads, aircraft vibration loads can be the primary design driver. The effects of aircraft harmonic vibration loads, as in a helicopter, are difficult to assess: some of the resulting inceptor system resonances can fall within aircraft frequency ranges that must be avoided.

This PhD project involves the derivation, development and study of a suitable mathematical model of an active inceptor, which can be used for assessing its dynamic characteristics. BAE Systems will provide a development helicopter collective stick unit and the associated CAD models for this investigation. The mathematical modelling, at least initially, be focused on this collective stick. Any experimental testing of this unit needed to support the modelling will be conducted either by BAE Systems or within the University. The objective of the study is to enhance the understanding of the dynamics of this candidate inceptor system, including under the influence of harmonic excitation representing helicopter vibration, and to explore methods for ensuring that resonant-frequency responses are avoided. Related topics such as friction modelling, force sensing and pilot arm interactions could potentially be incorporated at a later stage.

URL for further information:
BAE Systems active inceptor brochure: http://www.baesystems.com/en-uk/product/active-inceptor-systems.
BAE Systems Electronic Systems (Rochester site) overview: http://www.baesystems.com/en/our-company/our-businesses/electronic-systems.

Further Particulars

Candidate Requirements

Good undergraduate degree in Aerospace Engineering, Mechanical Engineering, or equivalent.

Self-motivated individuals are sought with excellent dynamics, mathematical and numerical modelling expertise, along with good communication skills and a willingness to work on an industrially focused PhD. Any experience in the fields of dynamics, mathematical modelling, numerical simulation, systems design and related topics would be useful, but not essential. Good experience in using Matlab and Finite Element Analysis Software is also desirable.

Informal enquiries

Dr D. Rezgui, email Djamel.Rezgui@bristol.ac.uk or
Prof. M.H. Lowenberg, email: m.lowenberg@bristol.ac.uk

For general enquiries relating to the application procedure, please email gsen-pgrs@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 “further details” box below with the name of the supervisor.

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