Title: Prediction and control of variation propagation in aircraft assembly

Project description:
Variations are ubiquitous and inevitable in manufacturing and assembly processes. Variations propagate and accumulate from part level to sub- and final assemblies, which imposes significant difficulty in downstream manufacturing processes (see Fig. 1), therefore affecting production cost and product quality. Handling variations for complex assemblies, such as an aircraft, is a great challenge due to the stochastic and dependent nature of variations. To tackle the challenge, this project aims to create a variation volume prediction method as well as a variation control strategy in order to mitigate the negative effects of variation propagation, therefore minimizing the overall production time/cost and improving the product quality. Collaborated with Bombardier Aerospace Belfast and Northern Ireland Technology Centre, the project will work on real life engineering products with real engineering data. Apart from the support from supervisors, help is also available from industrialists, project engineers and postdoc researchers.
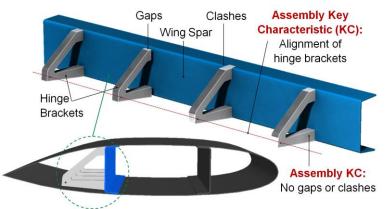

Fig. 1 variation propagation effects on assembly key characteristics

Aims and Objectives:
- Understand the variation sources
- Disclose the variation propagation mechanism
- Develop a computational method for variation volume prediction
- Propose a suitable statistical / AI method for identifying the dominant variations in manufacture and assembly
- Create management strategy to mitigate variation effects on production time and cost
- Understand the cost benefit by comparing to existing processes

Key skills required for the post:
- A minimum degree of 2:1 (or equivalent) in one of the following areas: Engineering, Science, IT, Mathematics or a closely related subject area.
- Knowledge of error modelling considered as advantage
- Knowledge of FEA considered as advantage
- Oral and written communication skills

Key transferable skills that will be developed during the PhD:
- Error modelling and control method
- FE simulation techniques
- Skills of homogeneous transformation and spatial geometry
- Method for cost benefit analysis
- Project and time management training to ensure milestones of the project are delivered.
- Effective dissemination of research findings through presentation at international conferences and publication in high quality technical journals.
- Interpersonal skills within a multidisciplinary team including academics and industrialists

Lead supervisor:	Name and contact details of person leading the research. Dr Yan Jin, email: y.jin@qub.ac.uk
Other supervisor(s):	Name(s) of anticipated other supervisors on project Prof. Adrian Murphy, Dr Gasser Abdelal
Guaranteed stipend:	The studentship covers UK/EU university fees and includes a tax-free stipend of approx. £14,925 per year. EU nationals not resident in the UK are only eligible for fees element.
Conditional top-up available:	£3000 per year, dependent on the recommendation of the interview panel. The student will be part of a major European project (H2020) that consists of multiple global leaders in aerospace manufacturing research. The student will have the opportunity to be seconded in our Chinese partner institutions (e.g., Tianjing University, Shanghai Jiaotong University, etc, for up to 12 months), where the cost of travel and living expenses will be fully subsidized (up to 2000 Euros / month).
PhD students in the School 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.