Queen's Doctoral Training Programme on
Secure Connected Intelligent Design and Manufacturing

Title: DTP: Secure Connected Manufacturing – Integrating Design and Cloud based Distributed Manufacturing

This project is part of the Queen's Doctoral Training Programme in Secure Connected Intelligent Design and Manufacturing. Many of today's industrial approaches require transformative changes to ensure long term societal, economic and environmental resilience and sustainability. PhD projects in this programme explore the potential of emerging digital technologies, such as artificial intelligence, robotics, and the Internet of Things, to transform the way we design, manufacture and operate products and services.

Project description:
The manufacturing industry has already started adopting the Manufacturing as a Service business model. For example, 3D hubs, Shapeways, Materialise and Sculpteo offer 3D printing services on an on-demand basis. Using these services customers can obtain customised 3D printed products at low cost. However, customers continue to become more demanding, they anticipate reduced turnaround time, increased quality innovative design etc. To satisfy such customers a Smart Manufacturing as a Service (SmartMaaS) framework is being explored in an exciting Design the Future project funded by the Engineering and Physical Sciences Research Council (EPSRC) called Building the Blind Watchmaker. This project adopts a Cloud-based design and manufacturing approach, where customers can submit their product request in the form of some specific parameters (design specifications) and receive the manufactured product after going through a process if design review and feedback. The challenge is to create an effective infrastructure where the manufacturing centre (e.g. the 3D printer, or router) communicates with the design system effectively to influence design decisions as they happen.

Aims and Objectives:
The goal is to develop constructs and algorithms to link design models in a CAD system with a suite of manufacturing facilities (3D printer, CNC etc) and to explore how both design model and process are mutually affected by changes.

The Objectives are:
1. Develop a suite of interfaces to enable interoperability between CAD system and manufacturing suite.
2. Carry out a range of experiments to explore and understand the propagation of variations throughout the system, and how feedback to engender design modifications may be effected and controlled.
3. Build a cloud based system to link the services together.
4. Create an intelligent interface to explore and compare human decision making versus AI decision making in such a system.

Key skills required for the post:
Solid background in engineering, with understanding of manufacturing systems, basics of computer systems and a good foundation in computer programming. Should be highly competent in the use of CAD systems.

Key transferable skills that will be developed during the PhD:
The programme offers a bespoke research and training programme that aims to develop students into cross-disciplinary, industry-conscious thinkers and leaders who will influence the roadmaps of future advanced manufacturing technologies and their applications. They will have a balanced understanding of ICT (security, communications and data analytics) in the context of their application to Advanced Manufacturing and High Value Design.

Lead supervisor:	Prof Mark Price, Mechanical and Aerospace Engineering, m.price@qub.ac.uk
Other supervisor(s):	Dr Peter Kilpatrick, Electronics Electrical Engineering and Computer Science, p.kilpatrick@qub.ac.uk Dr Sakil Barbhuiya, , Electronics Electrical Engineering and Computer Science, s.barbhuiya@qub.ac.uk

Guaranteed stipend:	This is a 3.5 year funded Queen's DfE DTPs studentship with Training Grant, to commence on 1 October 2020 (N.B. stipend for 20/21 is not yet known, but is likely to exceed £15,000). The studentship covers fees and maintenance and is available for UK residents (see full eligibility criteria - nationality, residency, and academic qualification at: http://go.qub.ac.uk/dfeterms). **When applying using the Queen's portal please ensure you include "DTP:" along with the project title.**
Conditional top-up available:	
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.