

# QUB - Mechanical and Aerospace Engineering PhD Project

**Title: Delivering a Distributed Smart Manufacturing System over the Cloud**

**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-demand basis. Using these services, customers can obtain customized 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 the 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 of 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.

In this project a range of technical challenges provide fundamental research questions such how can a manufacturing system self-organise and adapt as the design changes? To address this a prototype network of manufacturing centres (3D Printers, CNC) has been established, but the system is not fully connected, has no intelligence and therefore cannot deal with the fundamental question. The project therefore aims to explore the question on self-organisation by building intelligent interfaces/controlling agents and using a range of approaches from systems engineering to genetic algorithms evaluate and assess new processes for self-organising manufacturing systems. This is a challenging technical and theoretical project at the forefront of manufacturing technology today.

**Aims and Objectives:**

*The project aims to:*

*Explore how a distributed manufacturing system can self-organise to provide the optimum value for both manufacturer and customer.*

*The objectives are:*

- 1. Connect a range of manufacturing processes (printers, CNC) to form a unified distributed manufacturing cell and integrate with a CAD system.*
- 2. Develop a prototype manufacturing market on the cloud where manufacturing systems self-organise to optimise production of a component.*
- 3. Demonstrate ability of a manufacturing system to interact and change a design as it evolves in the CAD system.*

**Key skills required for the post: CAD modelling, Understanding on Manufacturing processes, basic software skills**

**Key transferable skills that will be developed during the PhD: Software development, cloud programming, interfacing and control of manufacturing systems such as 3D printers and CNC machines, digital manufacturing.**

**Lead supervisor:**

[Professor Mark Price](#)

<b>Other supervisor(s):</b>	Dr Trevor Robinson, Dr Declan Nolan
<b>Guaranteed stipend:</b>	This can include a basic stipend and any guaranteed top-up (if available). N.B. stipend for 20/21 is not yet known, but is likely to exceed £15,000.
<b>Conditional top-up available:</b>	Amount and condition
<p>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.</p>	

***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.***