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

Title: DTP: Human-Robot Collaboration in Disassembly for Future Remanufacturing

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:
Remanufacturing is the process of recovering, disassembling, repairing and sanitizing components for resale at "new product" performance, quality and specifications. Remanufacturing helps to reduce the manufacturing cost and environmental impact. A key step in remanufacturing is disassembly of the returned product to be remanufactured. Currently, most of the current disassembly tasks in remanufacturing are manual since they are too complex to automate this process as current products have not been designed considering disassembly. However, manual disassembly is a time consuming and costly process. Therefore, the automation of the disassembly tasks using robotic technology is necessary and important to reduce the cost and speed up the disassembly process. The robotic technologies generated through this project aim to make the disassembly process more collaborative with robot assistants working alongside humans. This human-robot collaborative system takes advantage of the strengths of humans (cognitive capability) and robotic systems (repeatability and high precision). This will require advancements in perception, planning, and control areas.

Aims and Objectives:
The aim of the project is to establish an integrated framework that automates disassembly in remanufacturing via the collaboration between human and robots. The objectives of the project are as follows:
- To identify task sequence of disassembly processes,
- To develop task sequence planning for robots in a human-robot collaboration setting to optimize operational cost and disassembly efficiency.
- To predict human behaviour and adapt robots trajectories accordingly to guarantee safety collaboration.
- To develop planning, learning and control for robots to perform disassembly tasks.
- To publish research outcomes in appropriate journals of international standing and to publish and disseminate the result of research and scholarship in other reputable outlets.

Key skills required for the post:
- A 1st class undergraduate degree in Engineering (Electrical and Electronics, Mechanical/Aerospace, Manufacturing, Mechatronics, other relevant subjects).
- Analysis and problem solving
- Project management and organization
- Good knowledge or experience of robotics, evolutionary computation methods and sensing and perception is desirable but not essential.

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:	Dr. Mien Van, School of Electronics, Electrical Engineering and Computer Science, email: m.van@qub.ac.uk
Other supervisor(s):	Prof. Adrian Murphy, School of Mechanical and Aerospace Engineering, email: a.murphy@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:	A top up may be available for an exceptional candidate, dependant on the recommendation of the interview panel and industrial sponsor.

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.