

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

School of Electronics, Electrical Engineering and Computer Science

PhD Studentship 2020/21

Proposed Project Title: DTP: Embedded systems security using Approximate Computing for Industry 4.0	
Principal Supervisor: Prof. Maire O'Neill Dr. Chongyan Gu Prof. Paul Maropoulos	Research Area Hardware security
Contact Details: QUB Address: ECIT, Queen's Road, Belfast, BT3 9DT Tele No: 028 9097 1722 E-Mail: m.oneill@ecit.qub.ac.uk; c.gu@qub.ac.uk	Proposal open to other School (indicate area of Interest) Mechanical Engineering, Maths & Physics
Degree linked to ELE (delete as appropriate)	
<p>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.</p> <p>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.</p>	
Project Description: The development of Industry 4.0 reduces production downtime, optimizes manufacturing system efficiency and improves product design. However, the move to industrial IoT devices and machine-to-machine communication poses serious security and privacy issues as there is not direct control over the connected devices. This opens up new attack vectors for hackers to exploit including the threat of malicious or tampered devices. Approximate computing has emerged as a promising paradigm for energy efficient designs. It is suitable for high speed and low power nanoscale integrated circuits and embedded systems for many applications where high accuracies are not required and intrinsic errors are acceptable in data, such as in the application of (deep-) machine learning, image processing and artificial intelligence. <p>However, security threats have emerged that threaten approximate computing systems since the uncertainty and unpredictability of intrinsic errors during approximate execution are difficult to distinguish from malicious falsification in the final output errors. In particular, approximate circuits are vulnerable to hardware attacking techniques. To date, there has been limited research into security countermeasures for approximate computing systems. This project aims to investigate these fundamental security issues of approximate computing and propose robust security approaches for embedded systems for Industry 4.0 applications.</p>	
Objectives: <ol style="list-style-type: none">1. Understand the challenges in the new age of approximate computing, where new computing architectures have introduced new vulnerabilities to embedded devices and integrated electronic systems.2. Investigate the security approaches in addressing the security vulnerabilities in approximate computing.3. Develop new secured approximate circuits for embedded systems.4. Investigate the security vulnerabilities of the proposed approximate circuits and provide countermeasures.	

Academic Requirements:

A minimum 2.1 honours degree or equivalent in Computer Science or Electrical and Electronic Engineering or relevant degree is required.

GENERAL INFORMATION

This 3.5 year PhD studentship, potentially funded by the Department for Employment and Learning (DfE), commences on 1 October 2020.

Eligibility for both fees and maintenance (approximately £15,000) depends on the applicants being either an ordinary UK resident or those EU residents who have lived permanently in the UK for the 3 years immediately preceding the start of the studentship. Non UK residents who hold EU residency may also apply but if successful may receive fees only.

Applicants should apply electronically through the Queen's online application portal at: <https://dap.qub.ac.uk/portal/>

Further information available at: <https://www.qub.ac.uk/schools/eeecs/Research/PhDStudy/>

Closing date for applications: 15 March 2020