

# PhD Project Proposal

**School of Electronics, Electrical Engineering and Computer Science  
& ECIT Global Research Institute**

**Proposed Project Title: Hybrid systems modelling and control for Industry 4.0**

**Principal Supervisor:** Dr Nikolaos Athanasopoulos      **Second Supervisor:** Prof Sean McLoone

## **Project Description:**

Hybrid systems are dynamical systems whose behaviour is a mixture of both continuous and discrete event dynamics. This flexibility allows for accurate analysis and enables the design of smart controllers for many engineered systems. Cyber-physical systems in digital manufacturing, coined by the term Industry 4.0, are by construction hybrid: they consist of a part that accounts for the physical process and a part that captures the behaviour of sensors, actuators, the communication network, the computing devices and the control algorithms.

Many emerging challenges in digital manufacturing have been identified to benefit from a hybrid systems modelling, such as the scheduling of large scale systems, control over networks, path planning of unmanned ground vehicles etc. The universal characteristic of the aforementioned challenges is the complexity of the underlying analysis and/or control problem. The existing solutions are either too simple, thus unable to guarantee an optimal and safe behaviour, or too complicated, thus not practicable.

The proposed project, rooted at the *i*-AMS centre philosophy, aims to use tools from applied mathematics, control engineering and computer science to propose provably correct, implementable controllers for benchmark problems in manufacturing. The project will start by building on recent preliminary results by the supervisor and collaborators involving scalable algorithms for the analysis and control of a particularly interesting family of hybrid dynamics, namely, constrained switching systems.

A 2:1 or higher honours degree in Control Engineering or a relevant field such as Electrical Engineering, Computer Science, Mechanical Engineering, Applied Mathematics, is essential. A strong mathematical background is desirable.

## **Contact details**

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