

**Topic: Sensors for enhanced control in robotic 3D printing**  
**Location: Loughborough University**

In this project the student will work on process and quality control related to large scale robotic 3D printing and machining for concrete parts used in specialist construction. A state-of-the-art hybrid robotic 3D printing and milling system has been developed at Loughborough University. This unique facility is enabling fundamental work to understand the unique capabilities offered by the system. As part of this pathfinding research activity, this PhD will investigate a new approach that, by using integrated in-process sensors and measurement systems, will enable the production of precision concrete parts with highly controlled geometric features and surface finishes. The project will focus on developing methods used to integrate measurement data within a digital manufacturing framework used to plan, define, and control robot tool paths for both deposition and removal of material.

The project will be supervised by Dr Peter Kinnell and Professor Richard Buswell, from the Wolfson School of Mechanical Electrical and Manufacturing Engineering, and the School of Architecture, Building and Civil Engineering at Loughborough University.

The position is available for UK candidates, but EU or International applicants who can pay the difference between the Home and International Fees would also be welcome to apply. Candidates must possess or expect to obtain, a high 2:1 or 1<sup>st</sup> class degree in a related science or engineering discipline.

### **Professor Richard Buswell**



Has over 30 years experience in building systems engineering in both industry and academia, and has been working in the field of additive manufacturing in the construction sector for more than 15 years. His research is multidisciplinary in nature and he has led a number of large research projects in the fields of building performance and 3D Concrete Printing. He is now currently engaged in leading two significant multi-disciplinary projects that will deliver the next generation of Hybrid 3D Concrete Printing processes.

### **Supervisor: Dr Peter Kinnell**



Is a Reader in Metrology and held an EPSRC Manufacturing Fellowship in Collaborative Metrology for High Value Manufacturing. He is the assoc. Director of the Intelligent Automation Centre at Loughborough University where he leads the research team working on 3D vision for robust intelligent measurement. He is currently working on the creation of new sensing technology, new algorithms for advanced data processing, and implementing measurement systems within automation and manufacturing systems.