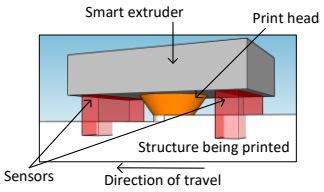
Smart adaptive extrusion technology for 3D printing

We invite applications for PhD studentships in the Adaptive Systems Research Group at the University of Hertfordshire to investigate and develop technologies for Fused Deposition Modelling (FDM) based additive manufacturing (more commonly referred to as 3D printing). Additive manufacturing has existed for more than 30 years since the first patent was filled in 1984 by Charles W. Hull. Technological advances coupled with the exportation of major patents in recent years have increased both the availability of 3D printing and the capabilities of 3D printers. 3D printers are being utilised for numerous applications including: the production of simple plastic objects in the home, printing vehicles, the development of soft robotics, the production of body parts and organs and the fabrication of buildings.



Currently the majority of FDM based 3D printers do not check what they are fabricating as they print, due to the fact that they lack the ability to verify that what they are producing is correct. As a result of this limitation FDM 3D printing can be somewhat unreliable and when a print starts there are no guarantees that the print will be successful. Some progress towards solving these issues has been made by enabling the printer to monitor the presence of printing material and the amount of material being deposited, but this is still only a solution to a small part of the problem. Research has investigated the possibility of a visual inspection system to verify that the physical object printed meets the specifications of the plan. When any structure is being assembled by a living creature the construction process relies on multiple means of verification to ensure that the structure is being built correctly. For example, when a builder lays bricks the builder will be checking the consistency of the cement mix, the gaps between the bricks, ensuring that the wall is straight and level and that the cement is adhering to the bricks properly. Because 3D printers do not have these sensory capabilities and are not intelligent, the printer does not verify that the material previously deposited was correctly applied which inevitably leads to failures.

This PhD will focus on developing smart adaptive printing technology to ensure that the printer is aware of what is printing, constantly checking that the structure is within an acceptable tolerance to the design specification and will fine tune the position of the extruder head in real-time to ensure this is the case. This will be facilitated using a range of sensors, including imaging sensors, to check the quality and flow of the construction material being used along with image processing to verify that the structure is being fabricated according to the specification.

Applicant requirements

Applicants will need to have excellent programming skills and the ability to use multiple languages with proven experience of programming hardware (robots or CNC based machines). Good working knowledge of G-Code, structured light scanning and FDM based 3D printing would be beneficial. Whilst a very strong degree is desirable, applications from individuals with proven experience only (no degree) are also welcomed.

For more information about this project or relevant questions, please contact:

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This project will be co-supervised by:

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