

PhD Project on Digitalisation of thermal spray using modelling and advanced machine vision techniques

Project description:

We seek PhD applications from the interested PhD students having UK/Home status for a quick start of April 2022. This PhD will boost your career in the area of thermal spray – a technology that is at the epicentre of Aviation and Gas-powered Energy engineering.

Thermal Spray coatings are critical to the performance of various products used as implants, turbine blades, cutting tools and automotive parts. However, coating processes have been slow to adopt digital technologies and are still largely underpinned by craft and skills rather than appropriate instrumented process control, resulting in the coating industry not achieving its full potential in terms of productivity. Thermal spray is a line of sight process in which the coating is built layer by layer. There is a need to perform in-situ work for real-time identification of the defects that occur during the coating growth including issues such as unmelts, insufficient splatting of the sprayed particles and other various types of defects well documents in the literature. Direct monitoring of the thermal spray process using FLIR camera and Accuraspray (an industrial standard for measurement of velocities and particles) would provide insights into these defects and thereby correct the process real-time. FLIR camera would give us the emissivity data that can be correlated with the particle temperature and velocity obtained from the Accuraspray. This will give us insights into why the microstructure of the coating is good or bad according to the application. This will eventually lead us to an improved understanding of the residual stresses and the fracture toughness of the coating.

The candidate will have an opportunity to process the thermal spray data obtained using high-speed cameras and FLIR devices and input them to a model in high-performance computing platforms such as ARCHER-2 (Tier-1) and Isambard (Tier-2) high-performance computers. These codes will output tangible process parameters changes that the robots can use to self-correct the process. Through this project, the simultaneous tracking of splat formation using advanced machine vision techniques and the effect of those on the workpiece(s) through advanced modelling using high-performance computing will be demonstrated. The main steps in this research are the spatio-temporal segmentation of the captured continuous digital data into workpiece states and the subsequent splat-coating state interaction modelling.

Supervisory Team comprises Dr Saurav Goel, Dr Bugra Alkan and Dr Viswanathan. Dr Goel is Associate Director of the EPSRC NetworkPlus in Digitalised Surface Manufacturing (<https://digitalisedsurfacemanufacturing.com/>) run jointly with the University of Manchester. The successful candidate will benefit from a wide range of training on spray equipment, Robots, monitoring and diagnostic tools and with a seamless learning that will lead to industrial jobs. Informal enquiries should be directed to **Dr Saurav Goel** (goels@lsbu.ac.uk).

Requirements: Applicants must be of outstanding academic merit and should have (or be expected to gain) either a first class or an upper second-class Honours degree (or the international equivalent), or an MSc/MRes with distinction. Enthusiastic and self-motivated candidates from all countries with a background in Materials or Mechanical/ Mechatronics Engineering, Materials Science, Physics or Mathematics or a related discipline are encouraged to apply. Prior experience working with ABB or Fanuc Robots, PLC instrumentation is advantageous. Candidates will work hands-on and on-site at the lab. Candidates should be able to demonstrate that they are highly motivated, have excellent communication skills and undertake challenging tasks using their own initiative. This PhD is a School of Engineering Bursary covering fees and £18k stipend per annum for three years. As part of the candidate's academic development, the bursary agreement includes that the successful PhD candidate engages in 4 hours per week student contact time, comprising lab class assistance and extracurricular activity development.