

MANAGEMENT, PRODUCTION AND DESIGN

Optimisation of Additive manufacturing processes

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| Funded By | Dipartimento DIGEP FONDAZIONE CRT CASSA DI RISPARMIO DI TORINO [Piva/CF:06655250014] |
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| Context of the research activity | Additive manufacturing (AM) processes are complex and involve phenomena at several time and length scales. At a small scale, the formation and dynamic of the melt pool and the subsequent cooling rates play a key role in the quality of the final part at a larger scale. Because of that, understanding and monitoring the process are difficult, making the material portfolio and the corresponding field of applications still narrow. Numerical and analytical tools may unlock the full potential of AM. |
| Objectives | <p>Overall description: The research project aims to develop and implement advanced methodologies based on the design of experiments and numerical simulation tools that, bridging the variety of scales involved in an AM process, could support its optimisation and calibration. Cutting-edge technologies for quality control characterisation, such as computer X-ray tomography, will be central for calibrating and validating the numerical tools. The process will be investigated at all relevant scales necessary for the determination of the final quality of the part. The new tools will be validated by producing new components, using new or conventional/commercial materials.</p> <p>Objectives: In the metal powder bed fusion AM field, the PhD student will adopt a comprehensive approach for developing a numerical framework that can bridge numerical and analytical models that operate at several time and length scales. The connections among the models will be created and validated by designing ad-hoc experiments representative of the analysed</p> |

modelling and process scale. Advanced simulation techniques such as the finite element method and machine learning techniques will be at the base of the framework development.

Skills and competencies for the development of the activity

Applicants must have an MS degree (or equivalent) in Mechanical or Material Engineering. The candidate must have already acquired considerable skill in metal AM processes, including design optimisation, process optimisation, material characterisation and analysis. The candidate should have experience with techniques for characterising the quality of the product such as profilometer, Archimedes' balance and image analysis. The candidate should have experience with finite elements tool. The candidate should have a keen interest in additive manufacturing, including materials, quality issues and process control and optimisation. Excellent interpersonal and communication skills and a stated interest in interdisciplinary research are essential.