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MULTI-SCALE MODELLING OF ADDITIVELY MANUFACTURED MATERIALS TO LINK MATERIAL PROCESSING AND MECHANICAL RESPONSES

ENRICO SALVATI[*] AND CHINNAPAT PANWISAWAS[†]

[*] Polytechnic Department of Engineering and Architecture (DPIA), University of Udine
via delle Scienze 206, 33100, Udine, Italy
enrico.salvati@uniud.it

[†] School of Engineering and Materials Science, Queen Mary University of London
London E14NS, United Kingdom
c.panwisawas@qmul.ac.uk

ABSTRACT

Additive manufacturing (AM) has revolutionised the production of geometrically complex mechanical components, yet the relationship between material processing and the final mechanical response of the fabricated product is far from being well understood or controlled. This session, entitled "Multi-Scale Modelling of Additively Manufactured Materials to Link Material Processing and Mechanical Responses," focuses on the exploitation of multi-scale modelling approaches to connect the evolution of microstructural characteristics induced by AM processes with the resulting macroscopic mechanical properties.

The session will gather experts from academia, research institutions and industry to discuss recent advancements in multi-scale modelling techniques, including, but not limited to, analytical, finite element analysis, phase-field, machine learning, digital twin, data-driven approach. Topics emphasise the simulation of microstructural evolution during AM processes and the understanding of their influence on material response and structural integrity aspects. Significant attention will be devoted to the study of material inhomogeneities at different length scales, through theoretical and experimentally validated models. Presentations will highlight how these models can be used to optimise AM parameters for desired mechanical performance, enhance the reliability of AM components, and promote new material design strategies.

The symposium will mainly explore case studies on various metallic materials – although studies on other classes of materials are also welcome – showcasing the practical applications of multi-scale models in predicting and enhancing the mechanical performance of AM products.

This event promises to promote interdisciplinary collaboration, providing a synergistic platform for exchanging ideas and proposing new research directions. Attendees will gain insights into the latest computational tools and experimental techniques, driving forward the capabilities of additive manufacturing.