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DESIGN OPTIMISATION WITH MULTISCALE OR MULTIPHYSICS CONSIDERATIONS

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ABSTRACT

Topology optimisation is becoming a powerful tool to push the boundary of structural design. However, the complexity of the obtained design solution and the consequent challenges in fabrication by traditional manufacturing processes have been a challenge in wide application of topology optimisation. In recent years, this challenge is addressed by the rapid advance of additive manufacturing. It has been established that topology optimisation and additive manufacturing are well suited for each other. Multiscale topology optimisation offers a way to exploit these advantages that not only have optimal structural topology but also material architecture under single or multiple physics. Many challenges remain to be addressed. Efficient modelling techniques are critical to enable multiscale and multiphysics design optimisation as it involves many scales in space and time. Spatial scales can range from nanometers to centimeters as well as temporal scales from milliseconds to hours. It is therefore necessary to adopt or develop suitable methods to bridge the scales in both analysis and optimisation. With the capability of manufacturing with multiple material and porous material with precision, complex multifunctional structures can be printed without a significant additional cost but design of such complex multiphysics structures remains a challenge. The physical and mechanical behaviors of resultant materials and structures are strongly dependent on processing parameters and a design optimisation method that reliably accounts for the processing parameters is not yet established.

The purpose of this mini symposium is to provide a platform to bring together leading experts to discuss current challenges and latest technologies on multiscale and multiphysics design optimisation for additive manufacturing. It includes, but not limited to:

- Multiscale and/or multiphysics optimisation strategy,
- Multiscale and/or multiphysics simulation techniques for design optimisation,
- Numerical methods for design of microstructures or material architectures,
- Topology optimisation for additive manufacturing,
- Material design for manufacturability,
- Optimisation methods to incorporate geometric constraints,

- Topology optimisation with uncertainties arising from manufacturing,
- Methods to account for the physical effects of the manufacturing process into topology optimisation.