

## MODELLING, SIMULATION AND OPTIMIZATION OF FUNCTIONAL MATERIALS AND STRUCTURES FOR ADVANCED ADDITIVE MANUFACTURING

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### ABSTRACT

Functional materials are a class of advanced (meta-) materials and composites whose physical properties can be controlled by external stimuli such as temperature, pH, light, electric or magnetic fields. They include shape memory alloys, phase transforming materials, stimuli-responsive polymers and hydrogels. Due to their unique properties functional materials can be applied in numerous fields, from automotive to medical and pharmacology. Additive Manufacturing, also known as 3D Printing, has emerged as a technological frontier in the advancement of freeform production for complex parts using functional materials. To further accelerate this technology towards widespread adoption, computational modelling, simulation, and design optimization are of particular importance. However, this represents a fundamental, but challenging and currently under-developed topic, due to the tight connection between process, material functionalities, and the final design.

This Invited Session welcomes researchers and scientists to present their work on the latest state-of-the-art developments in modelling, simulation, and optimization of functional materials to aid 3D Printing of morphing and actuating structures, also known as 4D Printing. Talks will outline the specific problem and demonstrate the numerical and experimental studies being conducted to validate the proposed method. Areas of interest will include, but will not be limited to:

- Mechanical and multi-physical constitutive modelling of functional materials at different scales
- Modelling and control of innovative smart materials
- Computational simulation and discretization methods, including process modelling
- Topology and design optimization for functional materials and meta-structures
- Additive Manufacturing and 4D Printing technologies for functional materials
- Experimental characterization and validation methods
- Computer-Aided Design for applications