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DESIGN FOR ADDITIVE MANUFACTURING IN CONSTRUCTION

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ABSTRACT

The digital transformation of the construction sector is reshaping how buildings and infrastructure are designed, engineered and fabricated. Additive Manufacturing in Construction (AMC) plays an important role in this development by directly linking computational design with physical construction. Through digitally controlled material deposition, AMC enables geometries, material distributions and construction strategies that are difficult to realise with conventional methods. Fully exploiting this potential, however, requires new design approaches.

Design for AMC integrates architectural intent, structural performance, material behaviour and fabrication requirements from the outset. This is particularly challenging given the diversity of construction materials, from concrete and metals to bio-based materials. AMC also introduces constraints on build direction, deposition sequence, and functional integration. Rather than simply restricting design freedom, these constraints can become drivers of novel solutions. In this context, computational form-finding, shape optimisation and topology optimisation offer significant opportunities.

A further challenge lies in translating design information into fabrication data. Computational design, process planning, toolpath generation and robotic control must form an integrated workflow that reliably translates design intent into physical production. Monitoring and sensing can provide feedback to the digital design model, allowing deviations between intended and realised outcomes to inform subsequent design and fabrication decisions. Verification and validation remain essential for transferring these approaches into construction practice.

This invited session brings together researchers and practitioners from architecture, computational design, construction informatics, structural engineering, robotics, digital fabrication, and material science. It provides a forum for discussing the principles, methods, opportunities, and challenges of Design for AMC, as well as its potential to advance architectural design, engineering, and construction.