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Effect of Printing Process on Mechanical Properties of Interface between 3D Printed Concrete Strips

Authors : Wei Chen, Jinlong Pan

Abstract : 3D concrete printing technology is a novel and highly efficient construction method that holds significant promise for advancing low-carbon initiatives within the construction industry. In contrast to traditional construction practices, 3D printing offers a manual and formwork-free approach, resulting in a transformative shift in labor requirements and fabrication techniques. This transition yields substantial reductions in carbon emissions during the construction phase, as well as decreased on-site waste generation. Furthermore, when compared to conventionally printed concrete, 3D concrete exhibits mechanical anisotropy due to its layer-by-layer construction methodology. Therefore, it becomes imperative to investigate the influence of the printing process on the mechanical properties of 3D printed strips and to optimize the mechanical characteristics of these coagulated strips. In this study, we conducted three-dimensional reconstructions of printed blocks using both circular and directional print heads, incorporating various overlap distances between strips, and employed CT scanning for comprehensive analysis. Our research focused on assessing mechanical properties and micro-pore characteristics under different loading orientations. Our findings reveal that increasing the overlap degree between strips leads to enhanced mechanical properties of the strips. However, it's noteworthy that once full overlap is achieved, further increases in the degree of coincidence do not lead to a decrease in porosity between strips. Additionally, due to its superior printing cross-sectional area, the square printing head exhibited the most favorable impact on mechanical properties.

Keywords : 3D printing concrete, mechanical anisotropy, micro-pore structure, printing technology
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