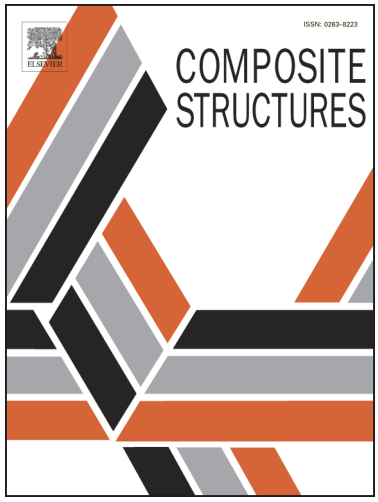

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Effect of fiber orientation on the rate-dependent flexural behavior of ultra-high-performance fiber-reinforced concrete

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ABSTRACT

This study aims to investigate the effect of fiber orientation on the flexural behavior of ultra-high-performance fiber-reinforced concrete (UHPFRC) under quasi-static and impact loadings. Two placement methods and two specimen sizes were considered to provide different fiber orientations, and image analysis was carried out to quantitatively evaluate the fiber orientation. Quasi-static flexural tests were performed according to ASTM standard, while impact tests were performed with two different potential energies (0.48 and 1.13 kJ) using a drop-weight impact test machine. Test results indicated that under quasi-static loading conditions, higher flexural strength, normalized deflection capacity, and toughness were obtained in the beams that contained better fiber orientation in the direction of the tensile load compared to those with poor fiber orientation; however, no obvious difference in the first-cracking properties was observed with respect to the fiber orientation. Under impact loading conditions, the flexural strength and energy absorption capacity were both increased with better fiber orientation, and a greater increase in the flexural strength with strain-rate was obtained in the beams with better fiber orientation at an identical potential energy (relative to their counterparts with poorer orientation). Therefore, providing good fiber orientation can be an effective way to improve the impact resistance of UHPFRC beams.

Keywords: Ultra-high-performance fiber-reinforced concrete; Fiber orientation; Impact; Flexure; Size effect

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