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Analysis of the Influence of Fiber Volume and Fiber Orientation on Post-Cracking Behavior of Steel Fiber Reinforced Concrete

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Abstract : The addition of fibers into concrete matrix can enhance some properties of the composite, such as tensile, flexural and impact strengths, toughness, deformation capacity and post-cracking ductility. Many factors affect the mechanical behavior of fiber reinforced concrete, such as concrete matrix (concrete strength, additions, aggregate diameter, etc.), characteristics of the fiber (geometry, type, aspect ratio, volume, orientation, distribution, strength, stiffness, etc.), specimen (size, geometry, method of preparation and loading rate). This research investigates the effects of fiber volume and orientation on the post-cracking behavior of steel fiber reinforced concrete (SFRC). Hooked-end steel fibers with aspect ratios of 45 were added into concrete with volume of 0,32%, 0,64%, 0,94%. The post-cracking behaviour was assessed by double punch test of cubic specimens and the actual volume and orientation of the fibers were determined by non-destructive tests by means of electromagnetic induction. The results showed that the actual volume of fibers in each sample differs in a small amount from the dosed volume of fibers and that the deformation and toughness of the concrete increase with the increase in the actual volume of fibers. In determining the orientation of the fibers, it was found that they tend to distribute more in the X and Y axes due to the influence of the walls of the mold. In addition, it was concluded that the orientation of the fibers is important in the post-cracking behaviour of FRC when analyzed together with the actual volume of fibers, since the greater the volume of fibers, the greater the number of fibers oriented orthogonally to the application of loadings and, consequently, there is a better mechanical behavior of the composite. These results provide a better understanding of the influence of volume and fiber orientation on the post-cracking behavior of the FRC.

Keywords : fiber reinforced concrete, steel fibers, volume of fibers, orientation of fibers, post-cracking behaviour
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