عنوان مقاله:

Constitutive Relations for Modelling Macro Synthetic Fiber Reinforced Concrete

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خلاصه مقاله:

The increasing utilization of Fiber-Reinforced Concrete (FRC) within the construction industry signifies a pivotal shift towards enhancing structural integrity and durability. Despite the predominant use of steel fibers, exploring macro synthetic fibers has gained momentum due to their potential to address critical challenges, such as workability reduction and corrosion resistance in FRC, without markedly affecting its structural performance. Among the forefronts of FRC research is developing an accurate constitutive model encompassing the diverse behavior of fibers, particularly synthetic ones. This discrepancy necessitates a distinct constitutive model for synthetic fibers to precisely characterize their tensile post-cracking behavior and regulate their design specifications. In this research, a preliminary constitutive model is derived through an inverse analysis procedure employing a Generalized Reduced Gradient (GRG) optimization method to the load-displacement results of the experimental testing of twenty ASTM C۱۶۰۹ beam samples. The results of the inverse analysis are used to correlate the ASTM C۱۶۰۹ residual flexural tensile strength parameters, fL/۶۰۰ and fL/۱۵۰to the stress-strain points defining the uniaxial tensile curve of macro-synthetic fibers, achieving coefficients of determination exceeding ۹۸.۵%. The model is statistically confirmed to be a valid constitutive relation for macro-synthetic fibers via successfully representing the post-cracking load-deflection behavior of standardized concrete beams, thereby outperforming traditional constitutive models in simulating the post-cracking behavior of FRC. Moreover, the model demonstrates robust predictive capabilities for the load-deflection curve of externally standardized samples, showcasing its potential for broader application in FRC design and analysis. Doi: ۱۰.۲۸۹۹۱/CEJ-۲۰۲۴-۰۱۰-۰۶-۰۶ Full Text: PDF

کلمات کلیدی:

Fiber Reinforced Concrete; Inverse Analysis; Macro-Synthetic Fibers; Constitutive Model; Residual Stresses; Stress-Strain Relations; Flexural Tests; Concrete Damage Plasticity; Finite Element Analysis.

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