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An Experimental and Analytical Study on Fatigue Damage in Concrete Under Variable Amplitude Loading

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Abstract

A fatigue model for plain concrete under variable amplitude loading is proposed by unifying the concepts of damage mechanics and fracture mechanics through an energy equivalence, in conjunction with the principles of dimensional analysis and self-similarity. The effects of stress ratio and overloads that accelerate the crack growth rate is included in the model, in order to capture the realistic behaviour under variable amplitude loading. Experiments are performed under variable amplitude fatigue loading in order to calibrate and verify the validity of the model. The model proposed in this work encapsulates the complex behaviour of concrete under fatigue and provides a more rational method for computing fatigue life of concrete structures.

Key words: Variable amplitude load, overload effect, Damage mechanics, Fracture mechanics, dimensional analysis, self-similarity

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