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Investigation of Fire Damaged Concrete Using Nonlinear Resonance Vibration Method

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Abstract : This paper attempts to evaluate the effect of fire damage on concrete by using nonlinear resonance vibration method, one of the nonlinear nondestructive method. Concrete exhibits not only nonlinear stress-strain relation but also hysteresis and discrete memory effect which are contained in consolidated materials. Hysteretic materials typically show the linear resonance frequency shift. Also, the shift of resonance frequency is changed according to the degree of micro damage. The degree of the shift can be obtained through nonlinear resonance vibration method. Five exposure scenarios were considered in order to make different internal micro damage. Also, the effect of post-fire-curing on fire-damaged concrete was taken into account to conform the change in internal damage. Hysteretic non linearity parameter was obtained by amplitude-dependent resonance frequency shift after specific curing periods. In addition, splitting tensile strength was measured on each sample to characterize the variation of residual strength. Then, a correlation between the hysteretic non linearity parameter and residual strength was proposed from each test result.

Keywords : nonlinear resonance vibration method, non linearity parameter, splitting tensile strength, micro damage, post-fire-curing, fire damaged concrete
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