Experimental and theoretical dynamic system identification of damaged RC beams

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ABSTRACT

Dynamic system identification of RC beams i.e. natural frequencies, damping ratios and mode shapes is of high importance due to their special role in most civil engineering structures. In this paper, the effects of damage on dynamic characteristics of reinforced concrete beams are investigated experimentally. The possibility of obtaining load displacement curves through dynamic testing for in situ reinforced concrete beams is evaluated and the proposed methods are verified. Damage is considered as reduction in the flexural stiffness with increasing degree of cracking. A vibrating motor with aluminum flywheels to which masses could be attached at varying eccentricities are used for producing the dynamic cyclic loads. The variation in natural frequency, amplitude of vibration, damping and bending stiffness with increasing eccentric mass and for increasing degree of cracking are evaluated through steady state vibration at resonance with gradual increase of concentrated load at mid span. The changes in the secant stiffness with increasing degree of cracking and for increasing and decreasing concentrated static loads are obtained. Damping values are calculated from free vibration decay function using logarithmic decrement method. The results indicate that the damping ratio in the vicinity of the cracked region is not merely viscous, but rather is a combination of viscous and frictional damping. The contribution of the frictional damping will increase by increasing degree of cracking.