Abstract

The longitudinal axial strain in the plastic hinge regions of reinforced concrete (RC) structures has a significant influence on the behavior of RC structures subjected to reversed cyclic loading. This strain affects energy dissipation in the hysteretic response by causing the sliding along interconnecting wide flexural cracks. In addition, the strain also reduces the effective compressive strength of cracked concrete of the RC members, such as coupling beams, dominated by shear action. The research reported in this paper proposes a model to predict the axial strain in the plastic hinge regions of RC beams. The proposed model includes four path types: Path 1- pre-flexural yielding or unloading region Path 2- post-flexural yielding region Path 3- slip region and Path 4- repeated loading region. In addition, this paper provides an equation to predict the longitudinal axial strain in the plastic hinge regions subjected to reversed cyclic loading of various patterns. To verify the longitudinal strain in the plastic hinge region by the proposed method, twelve RC beams were tested under reversed cyclic loading. The observed longitudinal strains in the plastic hinge regions of the tested beams agreed reasonably with the calculated longitudinal strains.

Keywords: longitudinal axial strain; plastic hinge region; reversed cyclic loading; reinforced concrete beams loading patterns.