Development of Deep Neural Network-Based Strain Values Prediction Models for Full-Scale Reinforced Concrete Frames Using Highly Flexible Sensing Sheets

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Abstract : Structural Health monitoring systems (SHM) are commonly used to identify and assess structural damage. In terms of damage detection, SHM needs to periodically collect data from sensors placed in the structure as damage-sensitive features. This includes abnormal changes caused by the strain field and abnormal symptoms of the structure, such as damage and deterioration. Currently, deploying sensors on a large scale in a building structure is a challenge. In this study, a highly stretchable strain sensors are used in this study to collect data sets of strain generated on the surface of full-size reinforced concrete (RC) frames under extreme cyclic load application. This sensing sheet can be switched freely between the test bending strain and the axial strain to achieve two different configurations. On this basis, the deep neural network prediction model of the frame beam and frame column is established. The training results show that the method can accurately predict the strain value and has good generalization ability. The two deep neural network prediction models will also be deployed in the SHM system in the future as part of the intelligent strain sensor system.

Keywords : strain sensing sheets, deep neural networks, strain measurement, SHM system, RC frames