

# DAMAGE ASSESSMENT OF REINFORCED CONCRETE USING ULTRASONIC WAVE PROPAGATION AND PATTERN RECOGNITION

Chikako Kondo

Graduate Student, Department of System Design Engineering, Keio University  
e-mail: konchika@xd6.so-net.ne.jp

Many approaches for structural health monitoring have been proposed for the purpose of maintenance cost reduction or performance guarantee of civil and building structures. Development of an active sensing diagnostic technique is needed to predict the location of structural damage during the maintenance. Although reinforced concrete has been used for many structures, damage assessment methods currently available for concrete structures still pose many problems associated with the variety of concrete material characteristics. In addition, they require involvement of experts in most cases. A new assessment method that resolves the problems is needed.

In this paper, a damage detection method for concrete structures using ultrasonic waves and pattern recognition techniques is proposed. AE sensors composed of stacked piezoelectric transducers (PZT) which can emit or record signals were used to generate and detect the ultrasonic wave propagation. At first, the proper frequencies of input waves were examined by means of comparing power spectrum densities and cross spectrum densities. The ultrasonic waves propagated through the damaged point of reinforcing bars were measured by the AE sensors to observe the arrival time and the amplitude to evaluate if those values contain some relevant information with the damage by comparing them with the undamaged case. Then, the Support Vector Machine (SVM) was built. The SVM is one of the pattern recognition methods and it allows precise and quick recognition. To increase the reliability and accuracy of classification, wavelet transform was jointly used to create the feature vectors for SVM. The feature vectors are generated considering the amplitude and time span. The results show that it has high accuracy of classification. Applicability of proposed damage detection method is finally discussed.

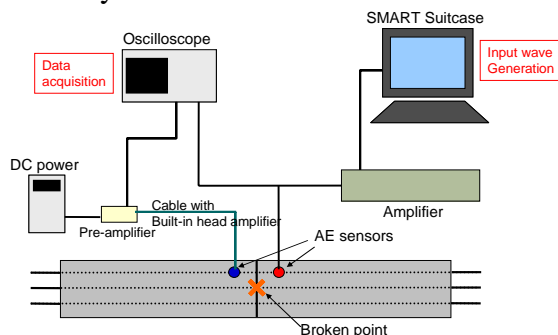


Fig.1 Experiment Setup

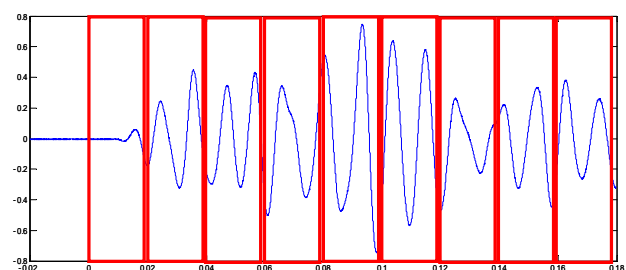


Fig.2 Creation of Feature Vector