Pattern Recognition Based on Time Series Analysis Using Vibration Data for Structural Health Monitoring in Civil Structures

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ABSTRACT: A statistical pattern recognition technique was developed based on the time series analysis to detect cracking in steel reinforced concrete structures using vibration measurements. The technique has been developed for the Sydney Harbour Bridge. The measurements were collected from single and tri-axial accelerometers, which were integrated into sensor nodes that were developed at the National ICT Australia. The approach is based on two staged Auto-Regressive (AR) and Auto-Regressive with exogenous inputs (ARX) prediction models. The variation between the residual errors obtained from the intact and damaged states were used to define a Damage Index (DI) capable of identifying physical changed which could be due to structural damage. The effect of the severity of damage on the deviation of the AR-ARX model from its intact state was also scrutinised. The results of the field trial and the laboratory testing demonstrated the ability of the approach in identifying the presence of cracking and handling large volumes of data in a very efficient manner.