

UNIVERSITI TEKNOLOGI MARA

**FATIGUE DAMAGE ASSESSMENT
OF REINFORCED CONCRETE
BEAM USING ACOUSTIC EMISSION
TECHNIQUE**

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ABSTRACT

Damage due to fatigue loading in a reinforced concrete (RC) beam is a crucial phenomenon that requires assessment. Acoustic emission (AE) technique can be used to identify the fatigue damage progression in the RC beam. Third point loading fatigue test was carried out in the laboratory of heavy structure on a small size RC beam of 150 mm x 150 mm x 750 mm and the actual size of RC beam of 300 mm x 600 mm x 4050 mm. The fatigue test was carried out based on various ranges of maximum fatigue loading, based on the first crack load, P_{cr} and ultimate static load, P_{ult} . Four objectives were outlined; to investigate the fatigue crack progression of RC beam specimens corresponding to the AE characteristic, to correlate damage classification of the RC beam specimens with respect to intensity analysis, to evaluate the fatigue crack characterization of RC beam specimens based on average frequency and RA value and to develop a new approach in fatigue damage assessment of RC beam specimens based on AE characteristics. RA value is the rise time divided by peak amplitude ($\mu\text{s/v}$ or ms/v). In the review, it was found that the analysis based on AE signal collected from channel basis is generally used. Channel basis is an analysis of AE data at a particular channel. Hence, a new approach in fatigue damage assessment of RC beam specimens based on AE signal collected from located event was developed. The located event is the analysis of AE data at a particular location which considers the AE signals captured from more than two (2) channels in a data set. It is also based on the time of arrival (TOA) of AE source to a particular channel. The analysis based on AE signal collected from the located event was compared with the AE signal collected from channel basis. It is found that the AE characteristics are dependent on the load application. Good agreements between AE characteristics, intensity zone, crack pattern and load application were found on the RC beams. The relationship between average frequency and RA value indicated clear trend with respect to crack classifications namely tensile crack and shear crack. It is found that the intensity of AE signal from located event shows reasonable plots to classify the damage corresponding to actual crack appearance than those from channel basis.

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