Quantitative evaluation of crack depths and angles for pulsed eddy current non-destructive testing

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Abstract

Cracks with inclination angles may potentially cause damage to a larger region in the tested structures. Their characterization, in terms of depth and angle, is therefore paramount for ensuring the integrity of the specimen under test. This study extracts features from Pulsed eddy current (PEC) signals obtained in a linear scan, perpendicular to the simulated surface cracks. The novel features extracted, termed skewness, LLS and LSmax, are capable of defining crack depth and inclination angles simultaneously. Multiple linear regression (MLR) was built to perform depth prediction, and the pre-determined depths were used in the hierarchical linear model (HLM) for angle prediction. The results were then compared with depth and angle prediction using artificial neural network (ANN). Better reliability of the ANN model with recorded RMSE of 0.198 mm and 2.903 in depth and angle prediction are highlighted. ANN is favourable in handling simultaneous prediction of crack depth and inclination angles, when using interdependent features. Meanwhile, HLM is still approved as a technique to provide a preliminary understanding of the crack parameters.

Keywords

Author Keywords: Pulsed eddy current; Linear scan; Feature extraction; Multiple linear regression; Hierarchical linear model; Artificial neural network; Defect quantification

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