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## Wireless power transfer-based eddy current non-destructive testing using a flexible printed coil array (Article) [\(Open Access\)](#)

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### Abstract

Eddy current testing (ECT) has been employed as a traditional non-destructive testing and evaluation (NDT&E) tool for many years. It has developed from single frequency to multiple frequencies, and eventually to pulsed and swept-frequency excitation. Recent progression of wireless power transfer (WPT) and flexible printed devices open opportunities to address challenges of defect detection and reconstruction under complex geometric situations. In this paper, a transmitter-receiver (Tx-Rx) flexible printed coil (FPC) array that uses the WPT approach featuring dual resonance responses for the first time has been proposed. The dual resonance responses can provide multiple parameters of samples, such as defect characteristics, lift-offs and material properties, while the flexible coil array allows area mapping of complex structures. To validate the proposed approach, experimental investigations of a single excitation coil with multiple receiving coils using the WPT principle were conducted on a curved pipe surface with a natural dent defect. The FPC array has one single excitation coil and 16 receiving (Rx) coils, which are used to measure the dent by using 21 C-scan points on the dedicated dent sample. The experimental data were then used for training and evaluation of dual resonance responses in terms of multiple feature extraction, selection and fusion for quantitative NDE. Four features, which include resonant magnitudes and principal components of the two resonant areas, were investigated for mapping and reconstructing the defective dent through correlation analysis for feature selection and feature fusion by deep learning. It shows that deep learning-based multiple feature fusion has outstanding performance for 3D defect reconstruction of WPT-based FPC-ECT. This article is part of the theme issue 'Advanced electromagnetic non-destructive evaluation and smart monitoring'.

### Author keywords

eddy current testing feature extraction flexible coil array resonant frequency selection and fusion  
wireless power transfer

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