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Compression of Multi-frequency Eddy Current Data using Principal Components Analysis for Pressure Tube to Calandria Tube Gap Measurement

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Inspection of components with multi-variable influential parameters may result in a loss of accuracy for the measurement of the target variable. A particular example occurs in the case of a pressure tube (PT) that is contained within a calandria tube (CT) in the fuel channels of CANDU® nuclear reactors. Eddy current (EC) based measurement of gap between PT and CT, as required by nuclear regulators, is affected by variation of PT wall thickness and resistivity, which may confound the accurate gap measurement. In this work principal components analysis (PCA) is examined as a means of simplifying changes in multi-frequency EC data so that the effect on EC signals from multiple parameters may be identified. PCA of analytical model and laboratory results are examined and redundant information in the multi-frequency EC data is removed. An additional benefit of PCA is compressed data acquisition, which permits increased inspection speed and monitoring of multi-parameter variation using a reduced number of variables.