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VIBRATION SIGNAL ANALYSIS USING WAVELET-PCA-NN TECHNIQUE FOR FAULT DIAGNOSIS IN ROTATING MACHINERY

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Abstract: Condition monitoring and fault diagnostics are useful for ensuring the safe running of machines. The demand for monitoring and fault diagnosis of processes and sensors in industrial systems has increased the efforts to develop new analysis techniques. In this paper, a new combined fault diagnosis method that uses Wavelet Transform (WT), Principal Component Analysis (PCA) and Neural Networks (NN) is proposed for rotating machinery vibration monitoring and analysis. In this proposed method, WT is employed to decompose the vibration signal of the sensor measurements into approximations and details coefficients at different levels. These coefficients are then used as inputs to the PCA algorithm in order to perform fault detection and feature extraction using Q-statistic or Squared Prediction Error (SPE) and Q-residual contribution, respectively. After that, NN are applied to further improve the separation between fault classes. The measurements from the vibration process are used to verify the WT-PCA-NN method for detecting and diagnosing faults under typical operating conditions. Simulation results using real sensor measurements from a pilot scale are presented and discussed.

Keywords : Vibration Signal; Fault Diagnosis; Wavelet Transform; Principal Component Analysis; Neural Networks.