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Comprehensive Feature Extraction for Optimized Condition Assessment of Fuel Pumps

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Abstract : The increasing demand for improved productivity, maintainability, and reliability has prompted rapidly increasing research studies on the emerging condition-based maintenance concept- Prognostics and health management (PHM). Varieties of fuel pumps serve critical functions in several hydraulic systems; hence, their failure can have daunting effects on productivity, safety, etc. The need for condition monitoring and assessment of these pumps cannot be overemphasized, and this has led to the uproar in research studies on standard feature extraction techniques for optimized condition assessment of fuel pumps. By extracting time-based, frequency-based and the more robust time-frequency based features from these vibrational signals, a more comprehensive feature assessment (and selection) can be achieved for a more accurate and reliable condition assessment of these pumps. With the aid of emerging deep classification and regression algorithms like the locally linear embedding (LLE), we propose a method for comprehensive condition assessment of electromagnetic fuel pumps (EMFPs). Results show that the LLE as a comprehensive feature extraction technique yields better feature fusion/dimensionality reduction results for condition assessment of EMFPs against the use of single features. Also, unlike other feature fusion techniques, its capabilities as a fault classification technique were explored, and the results show an acceptable accuracy level using standard performance metrics for evaluation.

Keywords : electromagnetic fuel pumps, comprehensive feature extraction, condition assessment, locally linear embedding, feature fusion
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