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A hybrid method for degradation assessment and fault detection in rolling element bearings

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Rolling Element Bearings (REBs) are key components in rotary machines, e.g., turbines and engines. REBs tend to suffer from various faults causing serious damage to the whole system. Therefore, many techniques and algorithms have been developed over the past years, to detect and diagnose, as early as possible, an incipient fault and its propagation using vibration monitoring. Moreover, some of the methods attempt to estimate the severity of the degrading system, to achieve better prognostics and Remaining Useful Life (RUL) estimation. While data-driven methods, such as machine and deep learning continue to grow, they still lack physical awareness and are yet sensitive to some phenomena not related to the fault. In this paper, we present a hybrid method for REBs fault diagnosis which includes physics-based pre-processing techniques combined with deep learning models for a semi-supervised fault detection. To compare and evaluate our results, we also compare performance of different detection methods on data from an endurance test with a propagating fault in the outer race. The methods we compare are both from physics-based and data-driven fields. The results show that the presented hybrid method including physical-aware signal processing techniques and feature extraction related to the bearing fault, can increase the reliability and interpretability of the data-driven model. The health indicator received from the proposed method showed better trendiness indicating the severity of the fault and improved the health track of the degrading system.

Keywords

anomaly detection, hybrid modeling, bearing fault diagnosis

Special/invited session

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