INFORMATION OF THE DOCTORAL THESIS

Name of thesis:	**Bearing fault Identification based on ANFIS and sensors derived data stream processing solutions**
Major:	Engineering Mechanics
Major code:	62.52.01.01
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Abstract

Bearing is a vital component, participating in almost types of machinery and technique systems. Reality has shown that a failed bearing may cause catastrophic accidents on vehicles moving at high speeds or unwanted influence on industrial systems related to unsafety, etc., and economic loss. Therefore, online monitoring of the operating condition of machines, including bearings, to ensure a safe operation and actively exploiting technical systems is always an urgent requirement. This task is even more significant in systems with high degrees of automation. For this aim, the thesis proposes some theoretical foundations for fault diagnosis of rotation bearings based on artificial intelligence and sensors-based measured data with the following main tasks.

In the first principal content, the thesis proposes a rotating bearing fault diagnosis method named ASSBDIM based on single spectral analysis (SSA), sparse filtering, and ANFIS. Here, instead of the displacement signal as in previous studies, ASSBDIM employs the acceleration signal to enhance the signal sensitivity of features. Via SSA and sparse filtering, preprocessing and extracting the meaningful information from sensors-based measured streams are implemented to build databases for the offline and online phases. The ANFIS recognizes the dynamic response of the bearings and then is optimized in the offline database. Ultimately, the failure status of the managed-bearing is defined well through the trained ANFIS and the online database. The thesis's second main content is the

BFDM algorithm for bearing fault identification. It is an inheriting and developing the first research above in applying the SSA and the acceleration signal of mechanical vibration. From a six-dimensional data space structured in the early step, the BFDM combines canceling high-frequency noise with optimizing this data space to set up databases in the form of features. It then predicts the bearing status via the databases and ANN - an ANFIS framework. In the last vital content, the thesis presents the third rotating bearing failure diagnosis method named ANFIS-BFDM utilizing ANFIS. Together with the inheritance from the two previous studies related to ANFIS and the SSA, ANFIS-BFDM delves into online noise filtering, finds solutions for minimizing domain disparity between source and target domains, and adaptive domain construction. It depicts an optimal data screening threshold through the low-frequency data region to develop an impulse-noise filter named FIN. In the offline phase, the ANFIS identifies the system's dynamic response via the data filtered in the adaptive domain. Eventually, the FIN and ANFIS are manipulated to filter noise and recognize health status of bearings in the online phase.

Along with the above-proposed algorithms, the thesis also focuses on designing and building an experimental system for collecting vibration measurement data of bearings. The measured database from this experimental apparatus is employed to verify the effectiveness of the proposed methods.

Keywords: Bearing fault diagnosis, Time series analysis, Noise measurement, Feature extraction; AI-based fault diagnosis

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