1. 목적

For the purpose of vibration-based fault detection and condition monitoring of rotating machinery, this study proposes a nonparametric multivariate control chart method based on multi-scale wavelet scalogram (MWS) to overcome the limitation posed by the parametric assumptions in the existing SPC methods.

2. 연구설계/ 방법론/ 접근방법

The presented approach takes advantage of multi-resolution analysis using discrete wavelet transformation, obtains MWS as features in significantly low dimension, and calculates Hotelling’s $T^2$-type monitoring statistic using MWS.

A bootstrap sampling is used to determine the upper control limit of monitoring statistic without any distributional assumption.

3. 연구결과

Numerical simulations demonstrate the superior performance of the proposed control charting method under various damage-level scenarios for a bearing system.

4. 실무적 시사점

Without any distributional assumptions of data model, the proposed method promises a comparably low false alarm rate (FAR) and quite sensitive to the level of damage severity for diagnosing a rotating machinery such as bearing system.

5. 독창성/ 가치

The use of standard multivariate SPC techniques for vibration signals is ill-advised because the sample covariance matrix is likely singular. Even though many feature-based SPC methods have been introduced to tackle this deficiency, most of methods require a parametric distributional assumption that restricts their feasibility to specific problem of process control and thus limits their applications. The proposed method overcomes this deficiency.

6. 키워드

Statistical process control; Fault detection; Bootstrap; Wavelet; Scalogram
7. 논문형식

- Research Paper ( ), Survey paper ( ), Technical or Engineering Notes ( ), Review ( ), Article ( ), Case Study ( )

8. 주요 참고문헌


9. 발표분야 및 발표자

- 통계적 품질관리 (발표자: 정 욱, ukjung@dongguk.edu, 010-5412-2519)