

School of Computer Science  
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# Automatic Ferroresonance Classification

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## Abstract

Ferroresonance is one of the most serious problems in electrical power system. It frequently occurs in electrical distribution system and is dangerous for most electrical equipment. As ferroresonance can be categorised into several modes, it is necessary to identify the mode before mitigation plan is built. A mitigation plan that is made without determining the mode could result in improper treatments to the network. Once occurred, ferroresonance mode must be classified as soon as possible to reduce potential harms to electrical equipment. As this problem is a real-time problem, an automatic ferroresonance mode classification system is required. However, there are only few published studies regarding feature extraction and automatic classification of ferroresonance mode.

The identification of ferroresonance mode in this project focuses on the classification of three ferroresonance modes: fundamental, subharmonic, and chaotic ferroresonance. Analyses on various feature extraction methods for identifying ferroresonance mode are given in this study.

This study proposes a novel method for automatic ferroresonance identification using Gammatone filter and Principal Component Analysis (PCA). Our proposed method works in hierarchical manner based on two SVM classifiers trained on different representations. First classification uses Discrete Fourier Transform as the feature extraction method and the second classification uses Gammatone filter with PCA. Such an application of Gammatone filter and PCA were never used before.

The first classifier is able to achieve 100 % of classification accuracy using linear kernel and the second classifier is able to achieve 99.7248% of accuracy using radial basis function kernel. The overall system achieves an average accuracy of 99.8165%. Moreover, the system could achieve 100% of accuracy when a majority voting method is used.

The outcomes of this study are analyses of feature extraction methods for classification and the automatic classification system itself.

**Keywords:** ferroresonance mode, automatic classification system, gammatone filter, majority voting, discrete Fourier transform