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IRREGULARITY DETECTION IN ARTIFICIAL SIGNAL USING TIME-FREQUENCY ANALYSIS

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ABSTRACT

A typical time signal contain overwhelming amounts of data and some of the signal components represent for irregularity such as crack and leak which greatly important to be identified precisely instead of using traditional method. The strategy can be done using signal processing method through high-quality time-frequency representation (TFR) for analysing such time dependent signals to accurately discover these superposition signal components. A few popular TFR methods such as wavelet transform analysis and relatively new, synchrosqueezed wavelet transform were applied in current study using artificial signal. From the result, both methods successfully discover an irregularity in the signal with different degree of accuracy and it is shown that synchrosqueezed wavelet transform provide the best and detailed time-frequency representation.

Keywords: irregularity, time-frequency analysis, synchrosqueezed wavelet transform.

INTRODUCTION

For frameworks of enthusiasm to researchers and engineers, examining the changing properties of a framework is normally performed by investigating signal information from the framework, instead of direct investigation of every part. Propelled time-frequency analysis give an arrangement of exploratory approaches for investigating changing frequency content in a signal, which can then be connected with anomalies forms in a framework.

Methods of signal transforming are major in comprehension signals from a wide mixed bag of fields. Raw time-amplitude signal that was transformed into frequency domain distinguishes the frequency substance of the signal, which is regularly more helpful than time space data for examination of dynamic properties. A fourier transform of a time period arrangement, for example a data signal of tremor record, contains data in regards to the frequency substance, however it can't resolve the accurate onset of changes in natural frequency, as time of transient data is carried just in the phase of the change.

Time-frequency analysis is a technique for changing from a time arrangement into a two-dimensional representation of frequency substance as for time. A TF analysis, by communicating frequency content at distinctive segments of a record, takes into consideration examination of developing signs. Numerous application or specialized works were directed utilizing TFR device for instance as a part of mechanical shortcoming analysis (Li *et al.*, 2013) and (Dong and Chen, 2012), speech (Tantibundhit *et al.*, 2010), biomedical (Abdulla and Wong, 2011) and (Musselman and Djurdjanovic, 2012), electronic framework (Castillejos *et al.*, 2012), seismic (Zhao *et al.*, 2014) and (Zheng *et al.*, 2013), geotechnical (Sudha *et al.*, 2009), etc., in which different TFR techniques have been employed to extract significant physical parameters from the raw signals.

In this paper we show the probability of the time frequency representation to identify inconsistency in artificial signal. First and foremost, utilizing a couple of TFR strategies, we extract the instantaneous frequency to make a comparison then determine the best representation in time-frequency plane. At that point we apply that TFR strategy to identify irregularity in artificial signal.

TIME-FREQUENCY ANALYSIS STRATEGY

Introduction of time-frequency analysis

Time-frequency representations are more generally utilized for non stationary signal examination which a robust strategy to transform a one-dimensional signal x(t) into a two-dimensional function of time and frequency, TFR (x;t, ω) to concentrate pertinent data. There exist numerous sorts of TFR algorithms which most of these instruments fall into two classifications: linear and quadratic techniques (Flandrin, 1999), each of which has its own particular qualities and shortcomings.

In the first method known as linear methods, the signal to be investigated is portrayed by its inner products with a preassigned group of layouts, created from one (or a couple of) essential format by basic operations. Cases are the windowed fourier transform, where the group of formats is produced by translating and modulating an essential window capacity. Another example is wavelet transform, where the layouts are gotten by translating and dilating the basic or so called mother wavelet.

The second strategy of TFR was quadratic method, which the signal is directly compared and evaluated without preceding a family of templates. Subsequently, a few components can have a crisper,