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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

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**Mechanical vibration and shock - Signal processing - Part 3:
Methods of time-frequency analysis**

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Foreword

GB/T 29716 "Mechanical Vibration and Shock Signal Processing" is divided into the following parts.

---Part 1.Introduction;

---Part 2.Time domain window of Fourier transform analysis;

---Part 3.Time-frequency analysis method;

---Part 4.Impact response spectrum analysis.

This part is Part 3 of GB/T 29716.

This section was drafted in accordance with the rules given in GB/T 1.1-2009.

The translation method used in this part is equivalent to ISO 18431-3:2014 "Mechanical Vibration and Shock Signal Processing Part 3.Time-Frequency Analysis" method".

The Chinese documents that correspond to the international documents cited in this section are as follows.

---GB/T 2298-2010 Mechanical vibration, shock and condition monitoring vocabulary (ISO 2041:2009, IDT)

---GB/T 29716.1-2013 Mechanical Vibration and Shock Signal Processing Part 1.Introduction (ISO 18431-1:2005,

IDT)

This part is proposed and managed by the National Mechanical Vibration, Shock and Condition Monitoring Standardization Technical Committee (SAC/TC53).

Drafting organizations of this section. Shanghai Jiaotong University, China Southern Power Grid Power Technology Co., Ltd., Zhengzhou Machinery Research Institute Co., Ltd.

Introduction

Time-frequency analysis is suitable for the quantitative description of vibration or shock in the time domain and frequency domain. This method is conducive to the analysis of variable speed machinery

Vibration problems, such as cars with changing engine speeds, etc. Time-frequency analysis is also suitable for quantitatively describing mechanical impulse response, such as collision response.

Time-frequency analysis can describe the duration and frequency response of the impact. Frequency response can be expressed in terms of frequency, speed, or octave.

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It contains four methods. short-time Fourier transform, Wigner-Will transform, Joey-Williams transform and wavelet transform. By choosing appropriately

Taking characteristic parameters, each method can quantitatively describe the time and frequency components of shock and vibration, so as to realize the quantification of the specified machinery

description.

Mechanical vibration and shock signal processing

Part 3. Time-frequency analysis method

1 Scope

This part of GB/T 29716 specifies the sampling measurement of a given physical or engineering quantity (such as acceleration, force or displacement) over a period of time

Numerical calculation method for time-frequency analysis. Several mathematical formulas of time-frequency transformation are given, and requirements and suggestions are put forward for parameter recording.

The data can be obtained through the experimental measurement of the mechanical structure, and can also be obtained from the numerical simulation of the mechanical structure. Due to the variety of mechanical structures

Such as microscopic instruments, musical instruments, automobiles, processing machines, buildings and civil structures, etc., so the types of data involved are very wide. by

These data can determine the response of a machine or human body to mechanical vibrations and shocks.

2 Normative references

The following documents are indispensable for the application of this document. For dated reference documents, only the dated version applies to this article

For all undated reference documents, the latest version (including all amendments) is applicable to this document.

ISO 2041 Mechanical vibration, shock and condition monitoring vocabulary
(Mechanical vibration, shock and condition monitoring-Vocabulary)

ISO 18431-1 Mechanical vibration and shock signal processing Part 1. Introduction
(Mechanical vibration and shock-

Signal processing-Part 1. General introduction)

3 Terms and definitions

The following terms and definitions defined by ISO 2041 and ISO 18431-1 apply to this document.

3.1

Short-time Fourier transform

A mathematical transformation related to Fourier transform, used to determine the dependence of harmonic frequency and phase on time in time-varying vibration.

3.2

Wigner-Vile distribution

Bilinear time-frequency description based on autocorrelation of vibration signals.

3.3

Generalized Wigner-Vile distribution

Time-frequency description based on autocorrelation of vibration signal with filtering processing.

3.4

Choi-Wiliams transform

Generalized Wigner-Wille distribution of vibration signal with specific kernel function.

3.5

Wavelettransform

Time-frequency description based on frequency scale transformation of vibration signal.

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