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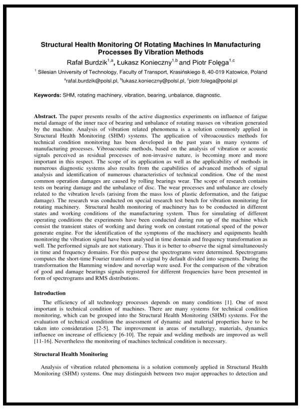

Structural Health Monitoring Of Rotating Machines In Manufacturing Processes By Vibration Methods

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Keywords: SHM, rotating machinery, vibration, bearing, unbalance, diagnostic.

Abstract. The paper presents results of the active diagnostics experiments on influence of fatigue metal damage of the inner race of bearing and unbalance of rotating masses on vibration generated by the machine. Analysis of vibration related phenomena is a solution commonly applied in Structural Health Monitoring (SHM) systems. The application of vibroacoustics methods for technical condition monitoring has been developed in the past years in many systems of manufacturing processes. Vibroacoustic methods, based on the analysis of vibration or acoustic signals perceived as residual processes of non-invasive nature, is becoming more and more important in this respect. The scope of its application as well as the applicability of methods in numerous diagnostic systems also results from the capabilities of advanced methods of signal analysis and identification of numerous characteristics of technical condition. One of the most common operation damages are caused by rolling bearings wear. The scope of research contains tests on bearing damage and the unbalance of disc. The wear processes and unbalance are closely related to the vibration levels (arising from the mass loss of plastic deformation, and the fatigue damage). The research was conducted on special research test bench for vibration monitoring for rotating machinery. Structural health monitoring of machinery has to be conducted in different states and working conditions of the manufacturing system. Thus for simulating of different operating conditions the experiments have been conducted during run up of the machine which consist the transient states of working and during work on constant rotational speed of the power generate engine. For the identification of the symptoms of the machinery and equipments health monitoring the vibration signal have been analysed in time domain and frequency transformation as well. The performed signals are not stationary. Thus it is better to observe the signal simultaneously in time and frequency domains. For this purpose the spectrograms were determined. Spectrograms computes the short-time Fourier transform of a signal by default divided into segments. During the transformation the Hamming window and noverlap were used. For the comparison of the vibration of good and damage bearings signals registered for different frequencies have been presented in form of spectrograms and RMS distributions.

Introduction

The efficiency of all technology processes depends on many conditions [1]. One of most important is technical condition of machines. There are many systems for technical condition monitoring, which can be grouped into the Structural Health Monitoring (SHM) systems. For the evaluation of technical condition the assessment of dynamic and material properties have to be taken into consideration [2-5]. The improvement in areas of metallurgy, materials, dynamics influence on increase of efficiency [6-10]. The repair and welding methods are improved as well [11-16]. Nevertheless the monitoring of machines technical condition is necessary.

Structural Health Monitoring

Analysis of vibration related phenomena is a solution commonly applied in Structural Health Monitoring (SHM) systems. One may distinguish between two major approaches to detection and

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Vibration transmission through rolling element bearings, part I: Bearing stiffness formulation

For this particular test setup, this factor was 1. TOP: PLUNGER MOTION, BOTTOM: ELECTRICAL SIGNAL OF ROTOR-TO-STATOR CONTACT RUB-RELATED. PHELOAD FOnCE COMPANY ; BENTLY ROTOR DYNAMIC PLOT No.

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SPACE SHUTTLE MOOEL M›chin«l ROTOR KIT ChU 4 2HO Staadg 9t«t« Uneomp 0. Rub— related steady— state occurrences are never

long-lasting due to continuously changing rubbing surface conditions grinding effect which produce variable radial load conditions, thus very often can be accompanied or alternated by transient processes.

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The useful linear range of eccentricities has been increased from the original 1.

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