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Continuous Scan, a method for performing modal testing using meaningful measurement parameters; Part I

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ABSTRACT

This paper presents the first part of a work about modal testing using meaningful measurement parameters. Scanning Laser Doppler Vibrometer (SLDV) systems are becoming largely used both in industry and university for performing vibration measurements. A reason for the success of SLDV systems can be found in their capability of measuring vibration remotely and under different environmental conditions which, when hostile, can inhibit other transducers to work correctly. Hence, SLDV system can be very practical and useful in many engineering applications. SLDV systems are being used as a contactless transducer measuring vibrations from a discrete number of measurement positions marked on the specimen whenever an optical access to it is available. Hence, the advantage of a modal test carried out using accelerometers and one carried out using a SLDV system can be: (i) the automation of the measurements and (ii) the increase of the spatial resolution of the measured modes. This suggests that SLDV systems can be used as a practical replacement of accelerometers operating the same measurement method. Continuous Scanning method is a novel approach of using contactless transducers for measuring vibrations. The most important difference between a discrete and a continuous approach is the method of measuring a vibration pattern. A discrete method measures the level of vibrations at discrete positions on a structure whereas a continuous method captures the modulation of the vibrations produced by the excited modes. This is possible when a transducer can travel across a vibrating surface. This first part of the work presents a new approach of continuous scanning measurement method using a multi-tonal excitation waveform. The paper starts from a comparison between a step and continuous scan mode to introduce a novel approach of continuous scan and multi-tonal excitation waveform. The objective of this first part of work is to present and understand that measurement parameters, such as measurement positions, and can be carefully chosen to improve the measurement technique. A laboratory test piece and a helicopter tail cone are used as examples for the application of this new measurement method approach.

1. Introduction

Experimental measurements are an important part of research studies, which aim to quantify physical phenomena. Mechanical measurements, like vibrational ones, are used to quantify vibrational patterns of structures that experience vibratory stresses during their operating condition as much spatially as dynamically. The quantification of such vibrations

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