Title Determining vibration levels for distribution testing

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Abstract

The laboratory simulation of random vibrations require two important ingredients: a Power Spectral Density (PSD) function and root-mean-square (rms) level(s). when field data is available, the mean PSD is calculated and the rms level can be defined by either the overall rms level (producing stationary vibrations) or, as is being recently encouraged, a statistical distribution of the rms level used to produce non-Gaissian vibrations. When field data is not available, the PSD is selected from a variety of sources, usually standards such as ASTM, ISO and ISTA while the rms level is restricted to single values depending on assurance levels. Vibration tests designed using this method do not allow for the synthesis of nonstationaly, non-Gauss vibrations as no information on the statistical distribution of the rms level is available. Although the recent introduction of various mathematical models for the statistical distribution of the rms and magnitude is promising, their application at promising, their application at present is not straight-forward. Many of the parameters used to describe these distributions do not bear relationship with physical aspects of the vibrations such as the peak-hold rms level, the rms range and kurtosis. To date. There exist no method by which a reasonably accurate estimate of the rms distribution can be constructed without field data. This paper proposes a method by which a statistical distribution of the rms levels is constructed from vehicle characteristics and pavement roughness levels. Estimates of rms levels are arrived at by bringing together published pavement roughness spectra for various roughness levels and Frequency Response Functions (FRF) of various vehicle types/payloads for various vehicle speeds. The result is a table of rms levels to which the user attributes of relative occurrence. The table make for a very practical and easy-to-use tool for constructing rms distributions required for non-Gaussian vibration testing. Existing data from vibration surveys undertaken in Australia and Spain were used to compare and validate the rms level estimates producted from the pavement roughness and vehicle types. The results show that there is good agreement between the measured data and those derived from published vehicle FRF and pavement roughness spectra.