Title Non-stationarity and kurtosis in vibration

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Abstract

There has significant recent debate and research on the differences between random vibration tests and actual journeys. The focus of this research has been on Kurtosis in actual journey. This presentation argues that there are three distinct and common causes of the non-Gaussian distribution of vibrational energy: transmitted vibration, non stationarity and isolated shock events. Important differences are identified between the statistical distributions and vibration characteristics associated with the three forms of non-Gaussian distribution; these differences impact strongly on the validity of methods that can be (in some cases are) used for kurtosis correction in vibration tests. Transmitted vibration can have non-Gaussian characteristics and these correspond to true Kurtosis in the raw data. Non-stationarity can lead to non-Gaussian characteristics being shown in summarized time-sampled data, but Gaussian characteristics in the raw data. Isolated shock events will probably represent a separate data set to the background vibration in terms of both energy distribution and power spectrum. The paper examines the commonly used method of split vibration tests (for example an 80:20 split) where a portion of the test in run at higher energy input to capture characteristics associated with non-stationarity. The paper argues that the nature of split used will depend on the characteristics of the vibration data source. The characteristics of the distribution of vibration intensity are shown to depend on both sample capture conditions and on vibration profile. A simple mathematical model is presented which demonstrates the above mentioned dependencies and potentially allows an iterative method for determining the need and best setting for split levels. The model is compared with the results of practical tests.