IMEKO 20th TC3, 3rd TC16 and 1st TC22 International Conference
Cultivating metrological knowledge
27th to 30th November, 2007. Merida, Mexico.

Primary vibration calibration by laser interferometry and mechanical shortcomings

T. Licht, S. E. Salboel

Brüel & Kjaer S&V.

Keywords: Primary vibration calibration, laser interferometry.

Introduction

Primary vibration calibration by laser interferometry using quadrature outputs has been used for the last 10-15 years. The ISO 16063-11 was published in 1999 and this has increased the interest further.

With new compact laser interferometers the difficulties of optical alignment and adjustment has been practically eliminated and dedicated software has made the process automatic, permitting to gather much more data.

Furthermore the advancement in electronic measurement capabilities, especially in high precision A/D converters, has made the electrical parts of the error budget very small.

Therefore today the dominating error sources are of mechanical nature. The problem that the laser beam not always can be directed towards the point or surface to which it ideally should be directed, introduces errors that can be quite significant and often will dominate the final error budget.

At low frequencies this is often due to non-ideal exciter motion, at high frequencies due to relative motion between points on apparently rigid mechanical structures. The ISO standards and other published material do not treat these problems in detail; only very general comments are given.

To help the calibration laboratories to a better understanding and agreement of uncertainties some practical examples, finite element modelling and corresponding measurements will be given. Examples of solutions to these problems including uncertainty calculations will be presented.

Conclusions

A discussion of the actual use and usefulness of data obtained on exciter structures that are significantly different in material properties from the structures where the transducer is going to be used afterwards is needed in the vibration society. This discussion is becoming more and more important because the tendency to use exotic materials for exciters have increased significantly together with the desire to measure accurately at higher and higher frequencies.