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Focus on IFA's work

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Hand-arm vibration: round-robin test to determine the measurement uncertainty

Problem

In order for the reliability of measurement results to be estimated, the measurement uncertainty must be stated. This value constrains the range of values within which, with a certain probability, the actual measured value lies. If different test bodies are to be assessed regarding the quality of their measurement results, the measurement uncertainty must be known. This value becomes more important when measurement data from different sources are fed into databases. It is also needed for the validation of risk analyses, for prognoses of vibration reduction and for programmes for this purpose.

A harmonized guide for assessment of the measurement uncertainty of different measured variables has been available for 20 years in the form of the "Guide to the Expression of Uncertainty in Measurement" (GUM). Before now however, the measurement uncertainty values for application of the GUM have not been available. Some of these values must be obtained by experimentation.

Activities

A round-robin test was conducted in order to determine the scatter between the test bodies (laboratories). The scatter between test bodies essentially comprises uncertainty components of the instrument, the sensor interface and the sensor position. In order to ensure that the conditions were identical, a hypothetical workplace

Round-robin testing of workplaces involving grinders, rotary hammers and jig saws

was set up involving three work tasks for two experienced workers.

Seven accredited test bodies took part in the round-robin test. They conducted measurements at different times and on different days to each other. In order to assure homogeneity, new tool attachments and materials were used on each day of measurement, and the procedure was monitored by an independent observer. For comparison of the measurement chains, further monitoring tasks were performed by means of a calibrator for three specified frequencies and amplitudes.

Results and Application

The orientation values of the relative measurement uncertainty were determined for the workplaces studied and input into the DIN SPEC 45660-2 specification in the form of relative test body uncertainties (u_M): rotary hammer u_M = 0.123, jig saw u_M = 0.093, grinder u_M = 0.312.

The result of the uncertainty budget was also compared with further parameters, and validated (EUROLAB TR 1/2006).

Area of Application

All areas

Additional Information

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Expert Assistance

IFA, Division 4: Ergonomics – Physical environmental factors

Literature Requests

IFA, Central Division

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