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Focus on IFA's work

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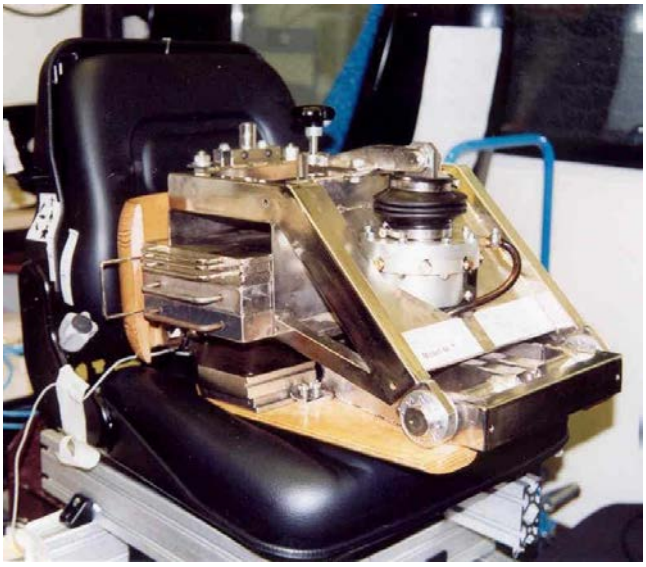
Dynamic dummy for the testing of drivers' seats

Problem

In order to reduce exposure to vibration, drivers' seats must be matched to the vibration characteristics (amplitude and frequency) of the vehicles in which they are fitted. Tests for drivers' seats can facilitate proper selection. DIN EN 30326-1 requires drivers' seats to be loaded with test persons of differing weight during testing. In order to avoid vibration exposure of human test subjects during testing and also to reduce statistical variance of the test results, the use of a dynamic test dummy was to be examined. The dynamic dummy is intended to deliver test results for drivers' seats that are as close as possible to those obtained using human test subjects of differing weight.



Driver's seat test involving a dynamic dummy

Activities

An improved mechanical dynamic dummy developed by the Bundesanstalt für Arbeitsschutz und Arbeitsmedizin (Federal Institute for Occupational Safety and Health – BAuA) for seat tests involving test subjects of differing weight was examined for its suitability for laboratory use. The BAuA launched and sponsored corresponding round-robin measurements involving seven test institutes. The test signals employed to control the vibration simulator corresponded to four different classes of earthmoving machinery under DIN EN ISO 7096 (also encompassing seats for fork-lift trucks, articulated trucks and industrial trucks).

One seat for each of the four vehicle groups under consideration was subjected to vibration excitation. A fork-lift truck seat with pitch vibration characteristic was also tested at the IFA. With the exception of two test institutes at which only one test person was employed in each weight class, three test persons and a dynamic dummy in each of the weight classes 55 kg, 75 kg, 98 kg were examined. The test criterion was the vibration transmission factor (SEAT) being the quotient of the frequency-weighted vibration acceleration upon the seat and at the seat mounting point.

Results and Application

In preliminary tests, the dynamic dummy with a weight of 75 kg modelled the seat behaviour with human test subjects the most and that with a weight of 55 kg the least closely. Optimization yielded an improvement in deviation to an average of 4% for the earthmoving machine seat, although the dynamic dummy continued to deliver a lower seat transmission factor (SEAT). Modification produced no improvement for the articulated truck seat. Overall, the SEAT values for the dynamic dummy were around 6% lower than those for human test subjects. The statistical variance of the results was around 20% for human test subjects, falling to 10% for dynamic dummies. The results showed the dynamic dummy to be suitable in principle as a substitute for human test subjects; the excessively favourable results for seats currently returned by the dynamic dummy, particularly for high-vibration machinery, do however necessitate improvement.

Area of Application

All sectors of the economy with an industrial element

Additional Information

- DIN EN 30326-1: Mechanical vibration; laboratory method for evaluating vehicle seat vibration; part 1: basic requirements (06.94). Beuth, Berlin 1994
  (DIN EN 30326-1/A1:2009,
  DIN EN 30326/A2:2012)

- DIN EN ISO 7096: Earth-moving machinery – Laboratory evaluation of operator seat vibration (02.10). Beuth, Berlin 2010

- EN 13490: Mechanical vibration – Industrial trucks – Laboratory evaluation and specification of operator seat vibration (03.09). Beuth, Berlin 2009 (Amends DIN EN 13490:2002, EN 13490/A1:2008)

- ISO 5007: Agricultural wheeled tractors – Operator's seat – Laboratory measurement of transmitted vibration (03.03). Beuth, Berlin 2003

Expert Assistance

IFA, Division 4: Ergonomics – Physical environmental factors

Literature Requests

IFA, Central Division

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