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APPLICATION OF CORRELATION TECHNIQUES IN FOUR-POSTER RIG DURABILITY TESTS

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ABSTRACT

Durability tests in laboratory conditions try to emulate real loads encountered by vehicles in realistic service conditions. In particular, road loads tend to be the dominant excitation that explains the majority of body, closures and suspension fatigue problems and for that reason test rigs capable of reproducing these input forces or displacements have been developed and are currently used as a standard tool in the vehicle development process.

The simplest form of a test rig for complete vehicle durability analysis is based on four independently driven hydraulic cylinders that reproduce the vertical displacement exhibited by the wheel hubs during driving conditions on severe tracks. The four cylinders are driven by a MIMO system that adjust the oil flow into each cylinder so that the time domain acceleration (or displacement) signal of each wheel, as measured during real driving conditions, is reproduced.

Although the reproduction of in-service acceleration time histories measured in the wheel hubs or some other body points of the vehicle is a common practice when performing durability test in four-poster rigs, additional processing of the in-service road load data can reveal fundamental information about the nature of the road excitation as an inducer of bending, torsion and rotation of the vehicle body and closures and its interaction with their dynamic behaviour.

This paper presents a case study based on the application of time domain and cross-correlation techniques in the frequency domain in order to explore the dominant relationship between the excitation applied to the vehicle by a four-poster rig and the spatial structural response of the vehicle body and its closures.