Rearview mirror vibration

SMR Automotive uses m+p international's SO Analyzer software for vibration testing vehicle rearview mirrors in the lab and in the field

Most car drivers take it for granted that their rearview mirrors will provide a clear picture of the traffic behind them under all normal conditions. To meet this expectation, mirrors, just like other, more 'glamorous', parts of the vehicle, must be rigorously designed and tested to ensure they perform to specification every time.

SMR Automotive is one of the world's largest manufacturers of exterior and interior mirrors and blind spot detection systems for light vehicles. The SMR plant in Portchester, Hampshire, UK, produces thousands of mirrors each year across a wide range of different designs for marques including Jaguar Land Rover, Volvo, Toyota and Nissan. To test the performance of its products during prototype development and in production, the company uses m+p international's SO Analyzer in conjunction with National Instruments' CompactDAQ modules. Testing is performed both in the laboratory and on a driven vehicle.

In the lab, the mirror assembly is mounted on a rigid test rig to simulate the vehicle body and subjected to excitation in the form of taps from a force hammer on the mirror (Figure 1). Measurements of the frequency response function (FRF) of the mirror glass are made using m+p SO Analyzer's FRF Impact Wizard, which provides facilities such as selection of data points/nodes, double impact detection/rejection, and visual measurement feedback to simplify and optimize data acquisition (Figure 2). Measurements are taken using a single three-axis accelerometer mounted at various points on the mirror in turn. (This minimizes the effect of the additional mass introduced by the transducer.)

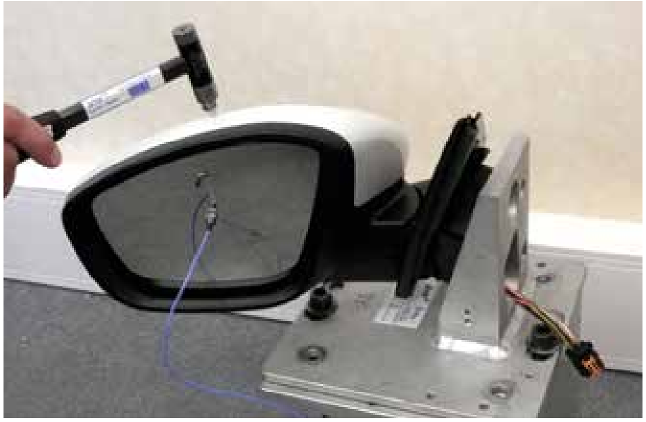

FIGURE 1: Impact testing in the laboratory using a force hammer (ABOVE)

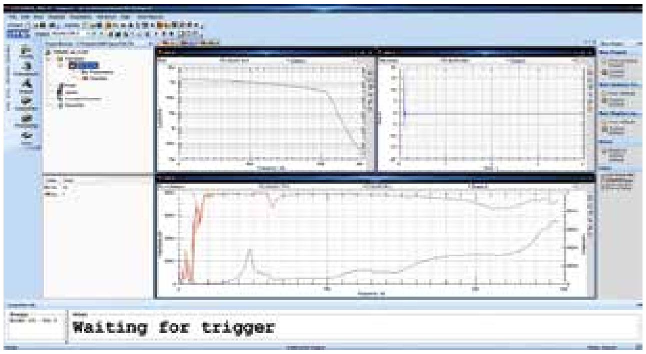

FIGURE 2: Impact test results (ABOVE)

FIGURE 3: An engineer preparing for road testing (LEFT)

The measured FRFs are analyzed by m+p's Advanced MDOF Wizard to calculate modal parameters: frequency, damping and mode shape.

These results are compared to the car manufacturer's specification to ensure compliance or to prompt further development work. Broadly speaking, the first mode for a manually retracting mirror will be greater than that of an automatically retracting mirror, the difference arising from the increased stiffness of the former. The mode shapes, which can be visualized by the m+p SO Analyzer, must be planar, to avoid the distortion of the image which would result from a torsional (twisting) mode. The results are also compared with a finite element analysis (FEA) generated at the design stage.

Based on the results, the design of the mirror's components can be tuned by small adjustments to the moulding process and component shape.

Drive testing is performed on a vehicle driven around a test track at different speeds up to a maximum specified by the OEM specification (Figure 3). Measurements of the frequency spectrum are taken using three-axis accelerometers mounted on each mirror.

Ian Booth, analyst at SMR Automotive, says, "m+p international's SO Analyzer enables us to perform our measurements accurately and in a repeatable manner with minimum fuss, enabling us to focus on perfecting the design for high-volume manufacturing."