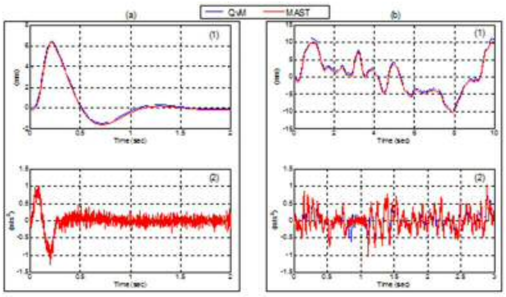
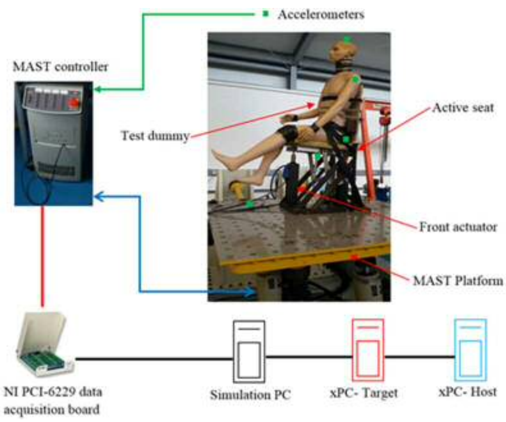
Research Project

Active Seat Suspensions for Automotive Applications

MAST



Quarter Vehicle Model and MAST tracking



Experimental setup for active seat

Motivation

Vehicle drivers are exposed daily to a range of different vibration levels from road roughness, in particular, at low-frequency (1-25 Hz) in the vertical direction. This effects the comfort and safety of vehicle drivers as the human body is very sensitive to low-frequency whole body vibration (WBV). In order to address this, low cost seat suspensions have been employed as they can directly isolate the driver from the transmitted vibration. However, passive seat suspensions have limited isolation performance, being dependent on the excitation frequency content and energy as well as the driver's characteristics, such as their weight. In contrast, active and semi-active seat suspensions are promising alternatives. The performance of these types of suspensions is highly dependent on control schemes and whilst the effectiveness of many control schemes have been proved via simulation, they are difficult to implement practically as they require unavailable, difficult or costly state measurements. Consequently, the development of simple and reliable control strategies that utilise obtainable and inexpensive state measurements is desirable.

Simulation of vehicle vibration using a multi-axis simulation table

A multi-axis simulation table (MAST) was used to replicate the sprung mass motion of a quarter vehicle using the principle of hardware-in-the-loop (HIL) simulation. The system is able to replicate the response to a range of road profiles including random and single bump inputs at frequencies up to 25 Hz. Also, uncertainties in the vehicle suspension characteristics, such as the damping coefficient, the stiffness rate and the vehicle mass were examined. The experimental results show the effectiveness of using the MAST to replicate vehicle vibration and hence for testing an active seat suspension.

Future work

New vibration control strategies will be tested experimentally using a prototype active seat.

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