

MODELLING OF SEATING DYNAMICS FOR PREDICTING SEAT  
TRANSMISSIBILITY

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A vehicle seat with an occupant is a complex dynamic system. The transmission of vibration through a seat to a driver or passenger is dependent on the dynamic properties of the seat, the biodynamic response of the body, and the interaction between the seat dynamics and the body dynamics. Modelling of a seat and human body dynamic system can assist the optimisation of the ride dynamics and comfort of road and off-road vehicles and reduce the risk of injury to operators and passengers.

The dynamic performance of a seat can be characterised by its dynamic stiffness and the biodynamic response of human body can be expressed by its driving point apparent mass. These two measures determine the transmissibility of a seat. This presentation starts by introducing measurements of the dynamic stiffness of seats, the apparent mass of the seated human body, and the transmissibility of seats. The characteristics of the apparent mass, the transmissibility, and the SEAT values of seats are summarised, and form a useful basis for supporting the dynamic modelling of the seat-human body system.

The modelling of seat dynamics and biodynamics involves various analytical and numerical or computer aided engineering (CAE) methods, such as lumped parameter techniques, multi-body dynamics approaches, and finite element methods. The presentation will briefly introduce these modelling methods and review the pros and cons of the individual approaches. It goes on to show examples including: (i) modelling of the fore-and-aft apparent mass of the human body and the transmissibility of seat backrests using lumped parameter techniques, (ii) modelling of a suspension seat with occupant for predicting transmissibility using a multi-body dynamics approach, and (iii) modelling of a car seat and seated human body to predict seat transmissibility using finite element methods.