Biodynamic Responses of Seated Human Subjects Exposed to Vertical Vibrations in Driving Conditions

阮長江、梁卓中

E-mail: 9510183@mail.dyu.edu.tw

ABSTRACT

ABSTRACT Automobile researchers become more concerned about vehicle vibration recent years and they are seeking more comfortable environments for occupants. Therein, seeking comfortably riding environments play a significant role in automobile manufacture. Practically, improving and equipping new devices entail high cost and large amounts of time. Therefore, it is necessary to save the cost and time of product development by using numerical simulation. In addition, studies of effects of vibration on seated human subjects have become commodious and popular. Most of seated human subjects are complex dynamic systems whose properties vary from moment to moment and from one individual to another. In this study, the main purpose is to concentrate on analyzing thoroughly the biodynamic response of the seated human body in driving conditions, including five primary objectives. The first is to provide an analytical study on two kinds of biomechanical human model: lumped-parameter and multi-body model. Analyzed results show that the multi-body model has good performances for purpose of this study. The second is to introduce and to analyze systematically two kinds of vehicle suspension systems: full-car and half-car models on two different road surfaces. For reality, full-car model is recommended for analyzing the generated dynamic responses due to road unevenness. The third objective focuses on the integrated human-vehicle model and riding evaluation of seated human in driving conditions. The ride quality level for integrated human-vehicle model over different road classes was evaluated by guiding of ISO 2631 (1979) ride quality standard for vertical vibration. The last one is to analyze the deep effects of contributing factors on biodynamics of seated human subjects such as location of driver/passengers, velocity and acceleration of vehicle, mechanical properties of seat (hip cushion, backrest support, and seat structure), sitting postures, and headrest support. The study presented in this study would provide a profound understanding of biodynamic responses of seated human subject and it may offer vehicle engineers a good reference in designing vehicle suspension systems.

Keywords : Biodynamics, seated human subjects, lumped-parameter model, multi-body model, half-car model, full-car model, backrest support, headrest support.

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