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Frequency-domain method for evaluating the ride comfort of a motorcycle

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In many European towns, the demand for fast and efficient mobility is frequently satisfied by means of two-wheeled vehicles. The improvement of comfort of two-wheeled vehicles used by tired and busy workers can increase safety in ground transport. Nowadays, multibody codes make it possible to predict the ride comfort of two-wheeled vehicles by means of time-domain or frequency-domain simulations. Comfort indices can be developed by post-processing the results of numerical simulations. This task is difficult, because the indices should depend on vehicle characteristics and should be independent of road quality and vehicle speed. Poor quality roads may generate nonlinear effects. Speed influences the trim of the vehicle and the wheelbase filtering, which takes place because the same road unevenness excites the front and rear wheel with a time delay which depends on the vehicle's speed.

In this paper, the comfort of two-wheeled vehicles is studied by means of a frequency-domain approach. The wheelbase filtering is averaged considering typical missions of the vehicle. The missions are journeys with a forward speed that assumes different values according to a probability density function. Indices of comfort are calculated taking into account the human sensitivity. The examples show that the proposed comfort indices depend on suspensions' characteristics and, hence, are useful design tools. Finally, some time-domain calculations are carried out to give emphasis to nonlinear effects and to show the limits of the frequency-domain analysis.

Keywords: Comfort; Motorcycle; Multi-body; Ride

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