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A QUARTER CAR SIMULATION MODEL FOR VERTICAL DYNAMICAL RESPONSE ANALYSIS

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ABSTRACT

The dynamics of a vehicle and its mechanistic understanding from the riding comfort and stability stand point of view has always been the critical area of research for dynamicists and manufacturers in the automotive industry. The dynamics is significantly influenced by disturbances, essentially unwanted vibrations induced due to kinematic excitations from numerous sources such as road terrain irregularities, aerodynamic forces and vibrations from mechanical assemblies. Designing a suspension system for optimal performance, preventing these disturbances to affect the passenger comfort while increasing riding capabilities and ensuring a smooth drive under different conditions, necessitates development of powerful, 'self-formulating' [1] computer models capable of numerically simulating a broad range of vehicular configurations and various conditions of real driving scenarios for response predictions. The paper delineates development of one such simulative ride model of a quarter of the vehicle and its subsequent implementation in MATLAB/Simulink for predicting dynamical responses to a variety of input excitations. The analytical qualification followed by parametric studies revealed the proposed model to be sensitive enough to vehicle configurations and suspension features, over and above the driving speed and road terrain roughness. The model, with appropriate treatment could be employed to help dynamicists and designers diagnose, analyze and optimize the critical dynamical attributes right at the design stage, eliminating the need of expensive prototype building and time consuming testing procedures.

KEYWORDS: Dynamics, Modeling, Simulation