ABSTRACT

The main purpose of presented thesis is to describe the process of building a two-mass vibrating system mathematical model called a 'quarter car model'. The essential feature of the model is taking a focus on the loss of contact between the tire and the ground as well as using a semi-active system for vertical vibration damping. Model construction was possible due to deep analysis of basic problems and innovatory approach to many issues. The model of contact with visco-elastic element was verified with harmonic, random and 'sharp' displacement forcing. Having compared the semi-active algorithms, the author decided to use the 'skyhook' algorithm using object's absolute velocity calculated with integration of acceleration measured by a piezoelectric sensor. Due to the author's study of road surface irregularities signal generation, it was possible to determine the influence of road quality and vehicle's velocity on the time of tire-road loss of contact. The final model was called a hybrid one because of its non-uniform physical structure and form of mathematical description. Model solving required studying the capabilities of selected numerical algorithms, considering method error values and building a calculating program with special low level algorithms in *FreeMat* environment.