

Abstract

In the work presented, a computational tool used for the dynamic simulation of railway vehicle systems is developed using multibody systems formulation based on the multibody techniques proposed by Shabana. With respect to other existing methodologies, the developed model uses a combined frame of references that permit the use of independent coordinates, without the possibility to have singularity configurations depending on the rotation sequence. The combined frames of reference used as a base for the formulation and modelling of wheel-rail contact problem with high precision. The program is designed in a flexible form that permits the study of different configurations of the railway vehicles as well as various track combinations. The main structure of the program has the ability of making changes for enhancement of the wheel-rail contact model or the implementation of dynamic structure of the track. An efficient contact model is implemented in the current work to precisely detect the coordinates of the contact points located at the wheel-rail interface. The developed simulation tool is applied for different case tests in order to validate the suitability of the proposed methodology for the analysis of railway systems. A comparison is made between the obtained results by the simulation tool presented in this work and the results offered by various simulation packages for the analysis of the Manchester Benchmark Vehicle. The tool is used to carry out the dynamical analysis for TGV locomotive vehicle and the results obtained are compared with these offered by SIMPACK package for the same vehicle model, at the same operating conditions. From the quality of the obtained results, it can be concluded that the presented simulation tool is reliable and efficient to be used in the dynamic analysis of different railway systems.