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Result accuracy and calculation speed in time domain simulation of railway vehicles. In C.L. Bottasso, P. Masarati, L. Trainelli, (eds.): Proc. of Multibody Dynamics 2007 (ECCOMAS Thematic Conference). - Milan, Italy, 25-28 June, 2007.

Abstract. In multi-body simulation, the dynamical behaviour of railway vehicles is usually analysed by means of time domain integration on the one hand and frequency domain calculation on the other hand. Calculations in the frequency domain (linear system response, spectral analysis) are fast but they use a linearised model description and they are restricted to running stability, passenger comfort, stochastic load data analysis and similar fields of application. The time domain integration is more versatile and also more accurate since it takes the full non-linearity of the vehicle model into account. Thus time domain integration today plays the most important role in vehicle design.
The paper analyses the effects of different modelling approaches and different integration methods on the calculation effort. The analysis uses a realistic railway vehicle model in the multibody simulation package SIMPACK. It is shown that, by choosing an appropriate integration method and reasonable assumptions for the modelling of the rail-wheel contact and other non-linear force elements, it is possible to reduce the calculation effort by the factor 50 and more. On the other hand, in certain situations this can lead to a severe reduction in the accuracy of the results. The paper analyses some critical situations, considering the requirements of several typical simulation scenarios such as curving forces or derailment analysis. It points out the potential and the limitations of different integration methods in regard to reducing the calculation effort whilst preserving a reasonable result quality.

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