MBS/FEM co-simulation for hybrid modeling of railway dynamics

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ABSTRACT

Nowadays in railway traffic, specific speed limitations exist depending on the train charge, due to a fragile subsoil or even an old building that has to be preserved. Depending on the type of vehicle, the type of soil or even the vehicle speed, the ground-borne vibration characteristics can significantly vary. It becomes thus important to predict the vibrations generated by a train passing on a track in the surrounding soil. In order to achieve this prediction, a hybrid modeling approach, consisting in a vehicle modeled using the minimal coordinates approach in multibody systems theory and a soil modeled using a finite element method, is developed. The recoupling of this hybrid system is performed using co-simulation between two different software packages with their own solvers. The first software is EasyDyn, a in-house C++ library package dedicated to multibody dynamics and the other software is ABAQUS that is dedicated to finite element analysis. The aim of this paper is to illustrate the results given by this hybrid model. Then two different co-simulation schemes (the sequential Gauß-Seidel scheme and the parallel Jacobi scheme) will be used and compared in terms of efficiency and accuracy for this specific railway application.