Assembly of a tire and a vehicle model to predict vibrations at the bushings
Application of a Frequency Based Substructuring method
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Abstract

This Master's thesis targets the prediction of vibrations at the bushings of vehicle rear chassis at the Volvo Car Group due to an excitation at the tire patch. In the past a hybrid model has been used, which included a FEM Model of the vehicle and through measurements obtained spindle forces of an existing tire vehicle combination. However it is reasonable that these forces are different for a new tire vehicle coupling. Thus, in this thesis the measurement data is replaced by a modal tire model, which is provided by Continental AG. Receptance Coupling is used to assemble one tire to the vehicle in the frequency domain. Thereby the vibration levels at the bushings are obtained due to an excitation at the tire patch for seven different harmonics. In addition to that, the sensitivity of the coupled solution to modal truncation errors in the tire model is investigated. Therefore an error metric is developed, which assesses the similarity between two FRFs using a floating bandwidth. As a result a minimum number of modes required for a desired frequency range and excitation case is given. In a second investigation, uniformly distributed random noise between ± 10 percent were added to the transfer functions of the tire and the vehicle model. The results show a deviation up to around 5 dB above the no-noise case, for the major part of the frequency range, but for some frequencies the coupled result show a greater sensitivity with deviation up to 20 dB for certain noise combinations.

Keywords: Dynamic Substructuring, Frequency Based Substructuring, Tire, Receptance Coupling Method, Generalized Receptance Coupling Method