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Title: Analysis of powertrain sound radiation behaviour by means of wave based technique

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The powertrain and in particular the exhaust system are the dominant sources during the so-called vehicle pass-by noise scenarios. In order to meet the legal regulations regarding the limit values for the vehicle noise emissions the computer aided engineering (CAE) tools came to the fore in the vehicle design process over the last three decades. This new emerging technology enabled that the acoustic performance of a product may be assessed in a cost-efficient way by analysing the virtual prototypes. The boundary element method (BEM) has become a well established tool for the analysis of acoustic problems involving unbounded domains. Since the dynamic boundary variables are expressed in terms of locally defined polynomial shape functions, a large number of elements is, however, required in order to get a reasonable prediction accuracy. As wavelengths shorten with increasing frequency, the computational mesh has to be refined which yields increased computational efforts. As a result, the practical applicability of the BEM is limited to low frequency problems.

Recently, the wave based prediction technique (WBT) has been developed as an alternative method for solving steady-state acoustic problems in the mid-frequency range. The WBT has proven to be a robust and efficient prediction tool for interior acoustics. This contribution outlines the recent developments of the novel wave based approach and its application for three-dimensional free-field sound radiation problems. Application to industry-sized problem demonstrates the enhanced computational efficiency, which allows the practical computational limitation to be shifted towards higher frequencies.