CADFEM Consulting

Simulation of Engine Acoustics in ANSYS® Workbench™

High Performance Computation for Acoustic Simulations

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Task

Acoustic radiation of vibrating structures such as large Diesel engines may significantly affect the comfort of staff and passengers. MAN Diesel and Turbo spends high efforts in improving the acoustic behavior of engines and engine components with respect to both, structural dynamics and acoustic radiation. Large structures, wide frequency bands, and many loadcases pose a challenge to simulation resources.

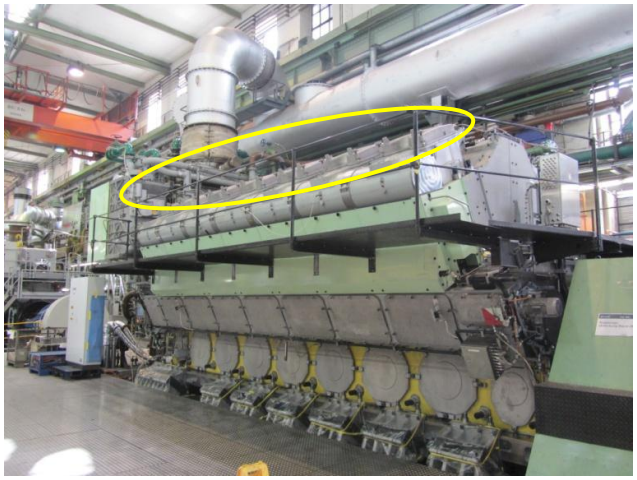
Solution

The simulation of acoustic radiation of vibrating structures typically requires a two step approach. A structural vibration analysis is coupled one-way to a subsequent acoustic analysis. In order to realistically describe sound pressure levels the analyst has to sufficiently describe the surrounding air volume in correlation to the noise frequencies. In order to speed up the simulation process a continuous repeatable workflow within ANSYS® Workbench™ was created. Instead of using just a single acoustic model, multiple models, each for a close frequency band, were generated automatically. Dependent on the considered wave length both, the size of the air volume and the mesh discretization, were parametrically adapted. In addition the new ANSYS HPC Parametric pack licensing was used in order to run 16 simultaneous jobs each using 4 cores economically. This way solution time of this acoustic radiation analysis was reduced by 93%.

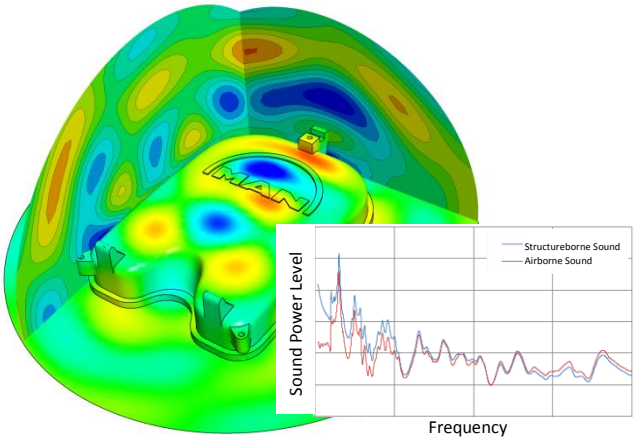
Customer Benefit

A reliable workflow for the simulation of the acoustic radiation of vibrating structures was created. In combination with the consequent usage of ANSYS HPC technology this empowers engineers to

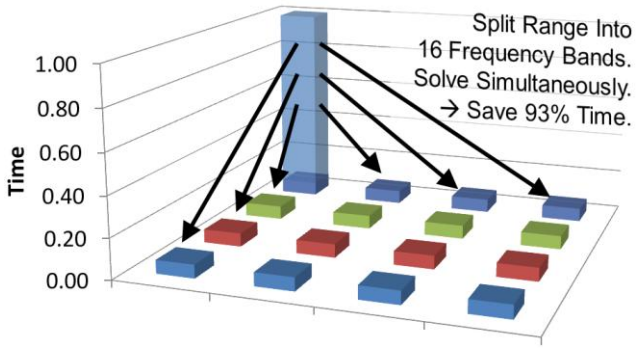
- acoustic decisions already in the early design phase of an engine,
- systematic parametric studies in order to understand the noise contribution of engine components,
- determine measures (e.g. damping layer, ribs, decoupling …) to cut down noise levels,
- save money and time by reducing the number of physical prototypes.



MAN Diesel engine and investigated part



Sound pressure contours and frequency response function of sound power level for a selected engine component



Significant reduction of elapsed time for acoustic simulation by means of HPC parametric distribution of harmonic analysis

Figures Courtesy of MAN Diesel & Turbo SE, Augsburg