Identifiant de la contribution : **218** Type : **non spécifié**

”EDRIVE#1 - Multi-Physic Analysis Of Power Electronic Control Parameters In A Simulation Framework”

jeudi 13 juillet 2023 10:40 (20)

Incorporating sound quality markers into optimization objectives is a new approach that aims to design more efficient and high-quality powertrains. In this paper, a digital framework, which combines different simulation environments, is proposed with the intent of investigating the influence of pulse width modulation strategies on vibroacoustic response and energy consumption of an electric drive unit. Different switching schemes and frequencies are relatively compared within this process. A high frequency, non-linear, 1D model of an electric drive unit is realized to estimate the phase currents and rotor position of a permanent magnet synchronous machine, for certain working conditions. These results are employed in a 2D electromagnetic FE model to estimate the magnetic forces in the air gap. The structural modes of the stator are calculated by means of finite element method. The vibration modes are used together with the magnetic forces generated previously to calculate a modal-based forced response. A vibroacoustic simulation generates the response up to 12.5 kHz for certain target positions. Finally, the acoustic spectral information is rendered in time domain and a sound quality assessment is performed on the synthesized signals using psychoacoustic metrics.

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Classification par session : Survishno 14 / NVH of eco-efficient powertrains