

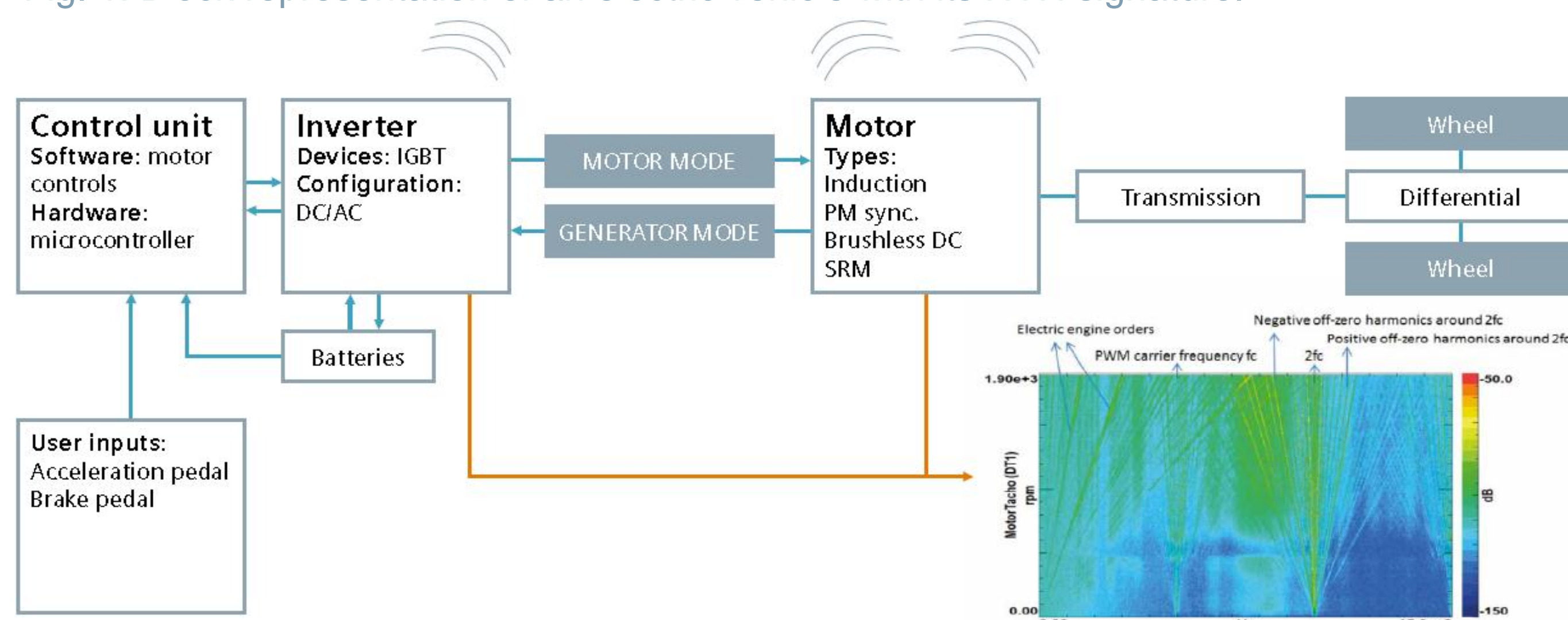
DEsign, MOdelling and TESTing tools for Electrical Vehicles powertrain drives – DeMoTest-EV

Improved concept modelling and NVH prediction for electrical drivetrains and vehicles

Introduction

Conceptually an electric traction unit can be resembled using this block diagram. The inverter transforms DC to AC using 6 insulated-gate bipolar transistors (IGBT's).

Fig. 1: Block representation of an electric vehicle with its NVH signature.



With the goal of improved NVH prediction capabilities for electric traction drives it is important to understand the link between the control unit, inverter, motor design and the acoustic noise radiation.

LMS Imagine.Lab & LMS Virtual.Lab

The DeMoTest-EV research project builds on the successful 1D, 3D simulation and test software produced by LMS. It investigates how such techniques can be extended to produce more accurate, meaningful results in the most efficient way.

Fig. 2: LMS Imagine.Lab model of an speed controlled induction motor.

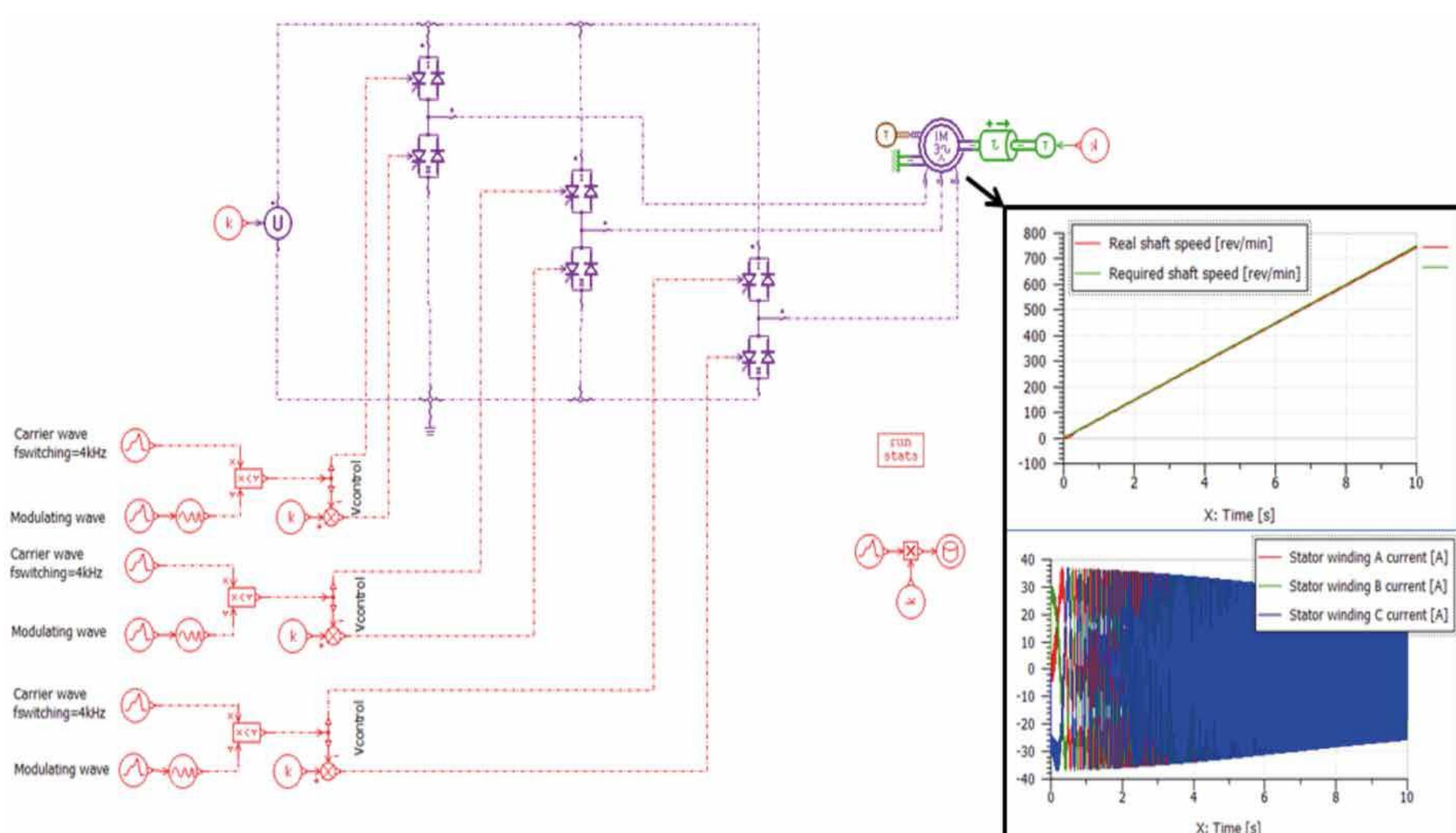
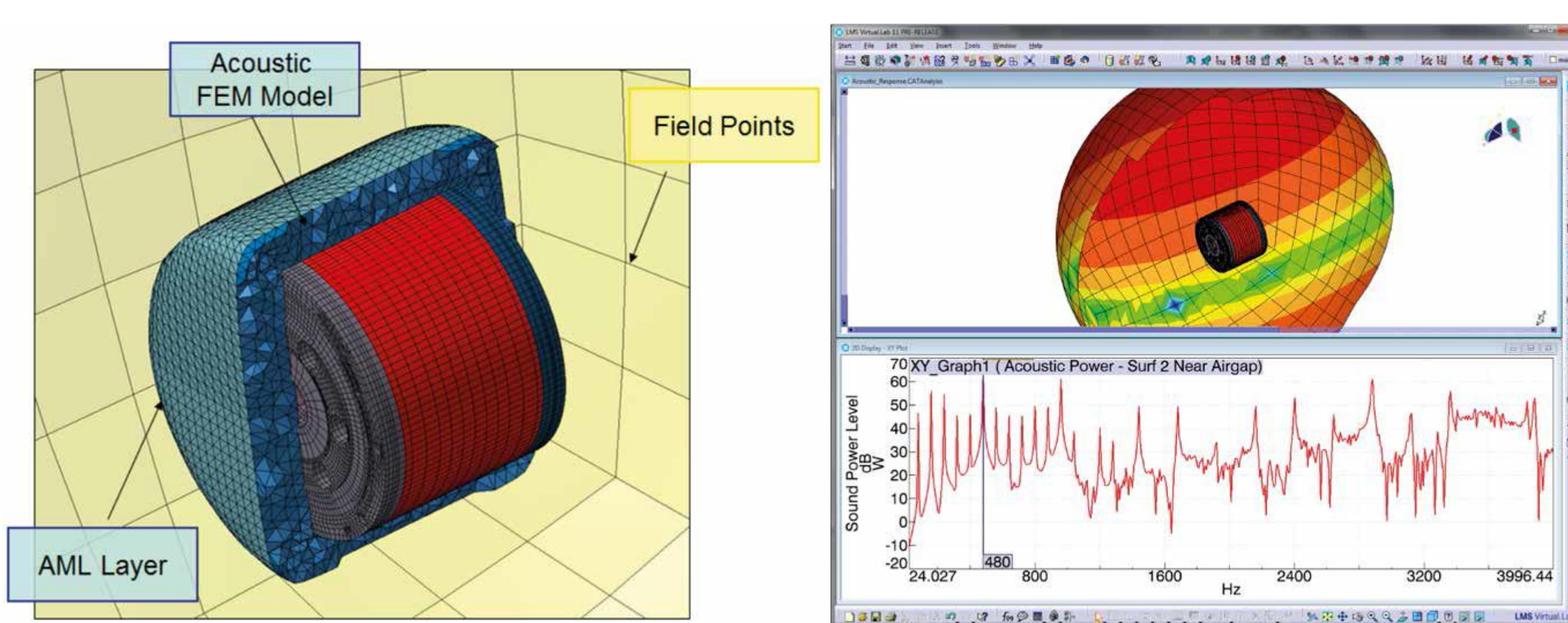
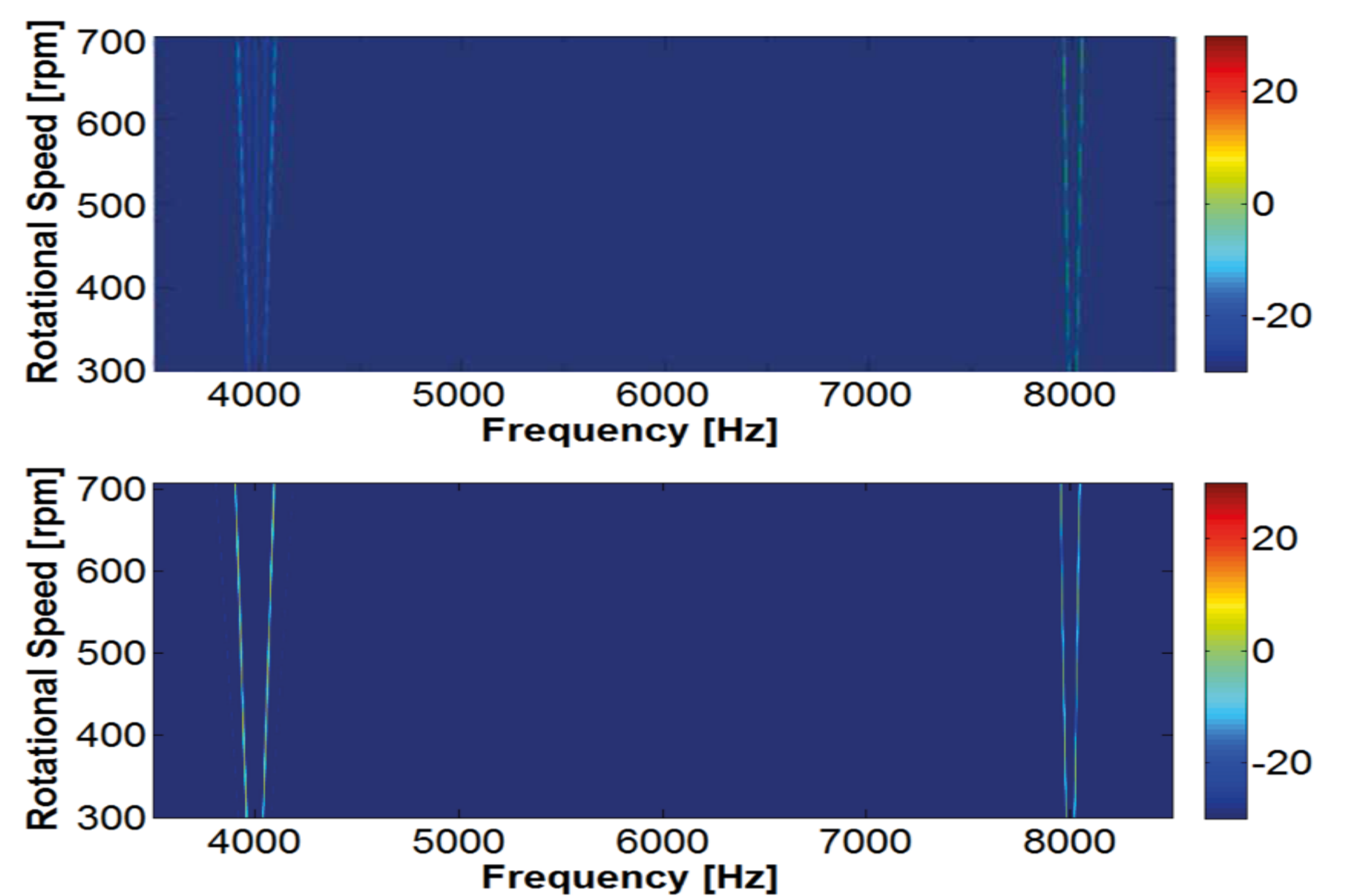


Fig. 3: View of a LMS Virtual.Lab acoustic simulation and a typical result for a noise radiation study of an SRM.



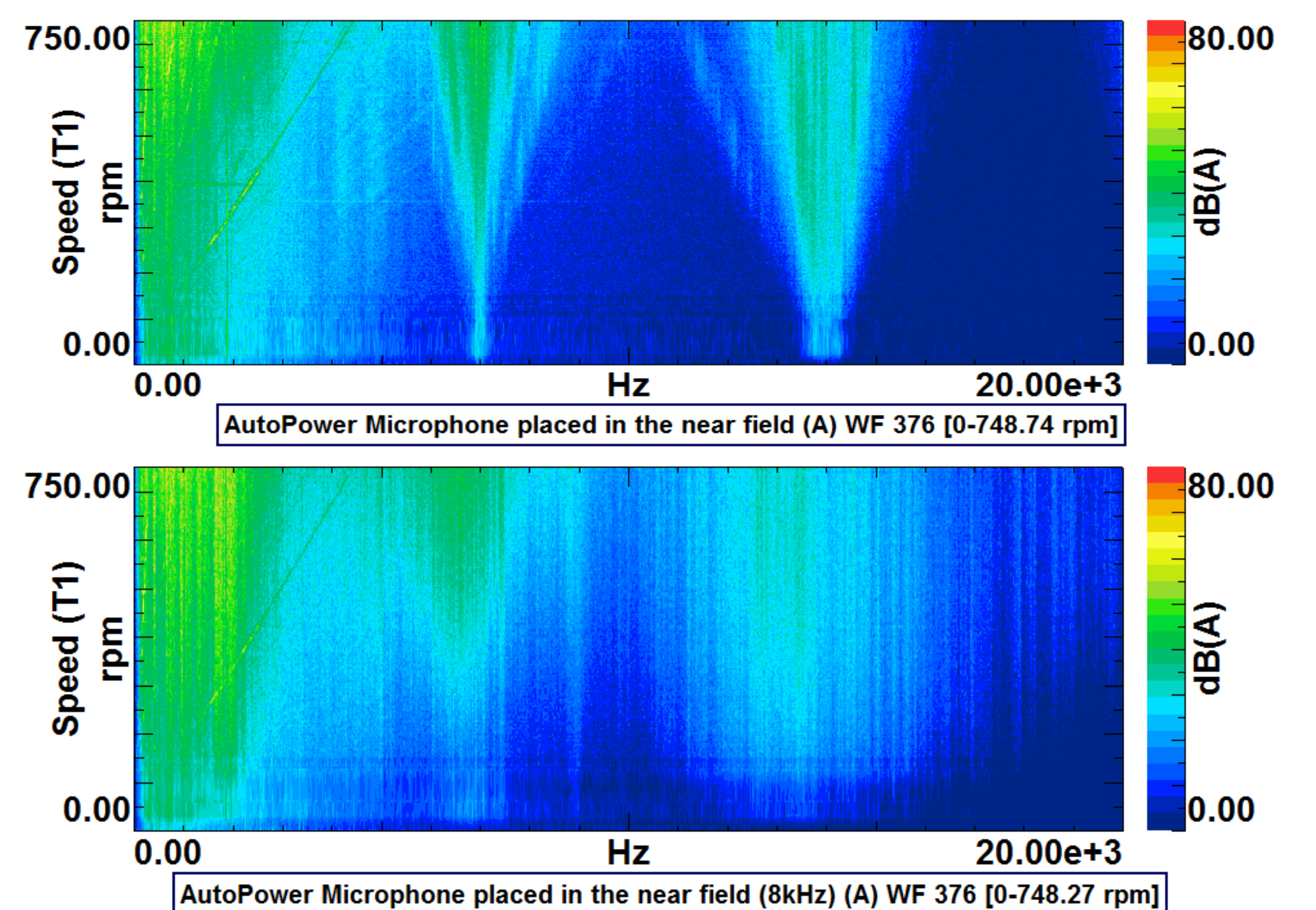
LMS Test.Lab: Experimental verification and validation of noise reduction techniques

Fig. 4: Measured (above) and simulated (below, using LMS Imagine.Lab IM model) frequency content of an induction motor current profile.



Initial results are encouraging, improvements in the sound quality of electric traction drives can be verified virtually and validated on real applications. Shown below is an example of a change in acoustic response by using a random switching frequency. It reduces the tonal carrier frequency noise which is typical for electric powertrain equipped with a variable speed drive.

Fig. 5: Experimental programmed PWM techniques to reduce the tonal content.



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