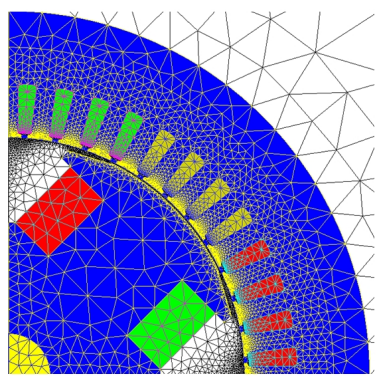
Electric motor NVH analysis via Flux-HyperMesh-OptiStruct

2D Multiphysics Summary

This application note presents the electromagnetic and vibro-acoustic modeling of a wound rotor synchronous machine with Flux 2D and OptiStruct. It allows extracting forces from Flux and run a vibro-acoustic simulation in OptiStruct in order to characterize the machine behavior. It includes an example from Flux, and one example in OptiStruct starting from the forces computed in Flux.

Applications	Flux main functions	Post-processed quantities
• Transient Magnetic • OptiStruct	• Synchronous motor layout • Extract forces for OptiStruct • Forces study, including 2D FFT and modal analysis	• Forces exported to OptiStruct for a vibro-acoustic simulation

Studied device	
The studied device, represented in the right figure, is a wound rotor synchronous machine. It is created by the dedicated overlay, as it is explained in the "read me" file. Due to its symmetries just one quarter of the device is simulated.	 *Figure 1: geometry and mesh of a wound rotor synchronous motor*

In practice

Open example=Open Flux + Run pyFlux command file

- Recommended memory configuration (standard): 1000 MiB Numerical + 50 MiB Character + 300 MiB GUI
- Computation time: 10' < t < 15' [64 bit - 16 GB RAM - 2.2 GHz]

Example 1: OptiStruct

The geometry is built in Flux 2D. A 3D file is created in order to be imported as geometry inside OptiStruct for the stator. The wound rotor synchronous machine is made through an overlay.

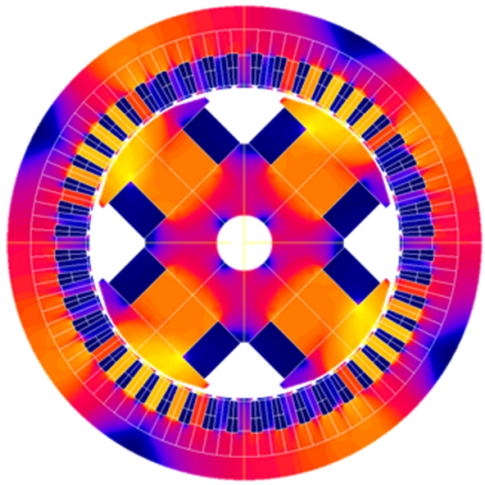


Figure 2: flux density in the machine at t=0s

The machine has a peak torque of 235 Nm, a max speed of 7500 rpm and a mechanical power rating of 180 kW at 7500 rpm.

The rotor is fed by a constant current source of 10A and the stator by an RMS current of 49.5Arms in the Q axis.

Forces in the stator-airgap interphase are computed and then sent to OptiStruct.

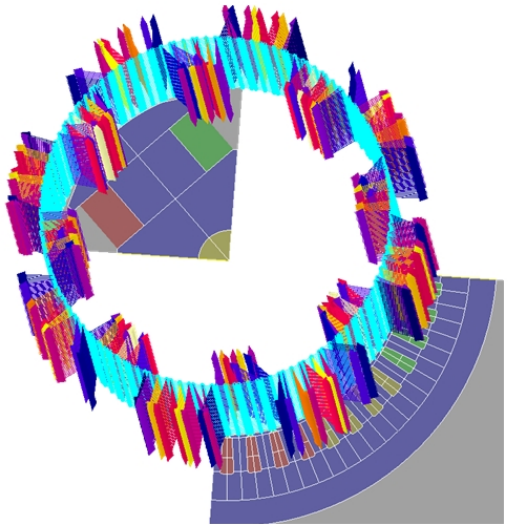


Figure 3: forces computed for t=4.166 ms