A Virtual Product Development Environment for Electronic Hydraulic Power Steering Pump Via Multi-Physics Modeling

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Abstract

Using advanced computational fluid dynamics software PumpLinx® and the COMSOL Multiphysics® software, a virtual product development environment was established for the electro-hydraulic power steering pump system in a passenger vehicle. The model built with the COMSOL Multiphysics® software provides a complete design optimization and validation framework. The success of the framework depends on the FE models and correlation to test results. A multiscale modeling scheme was used to ensure boundary conditions and material properties are chosen so that all level simulation results are consistent and correlate to existing test result very well. Under this framework, a lot of structure and performance design improvement and optimization were made virtually before real bench and vehicle design validation tests, and thus allowed more design update and validation cycles during the product optimization phases. Improved product quality and on time delivery capability in a vehicle development program can be expected.

Figures used in the abstract

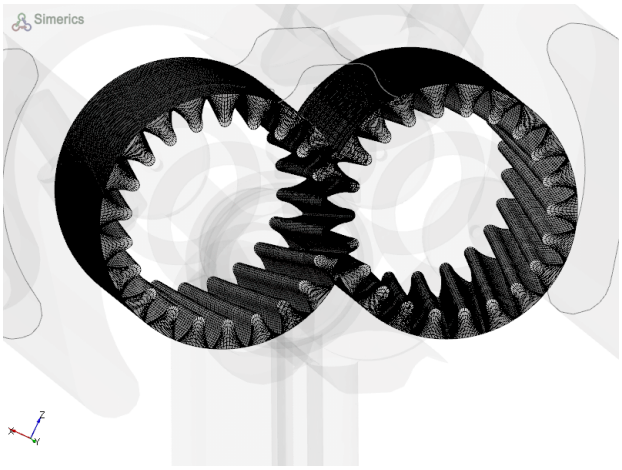

Figure 1: External helical gear pump CFD analysis.

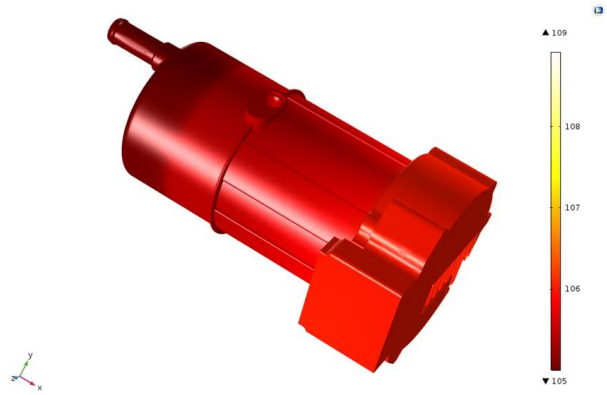

Figure 2: Steering pump assembly thermal analysis.

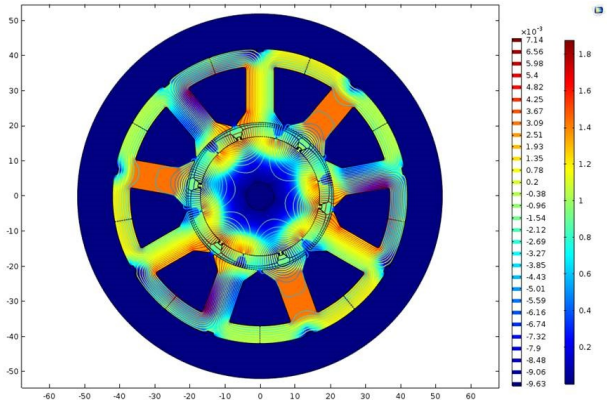

Figure 3: PM motor electromagnetic analysis.

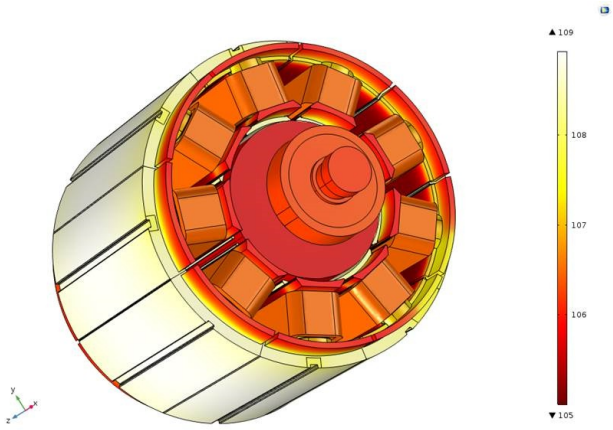

Figure 4: Stator and rotor thermal analysis.