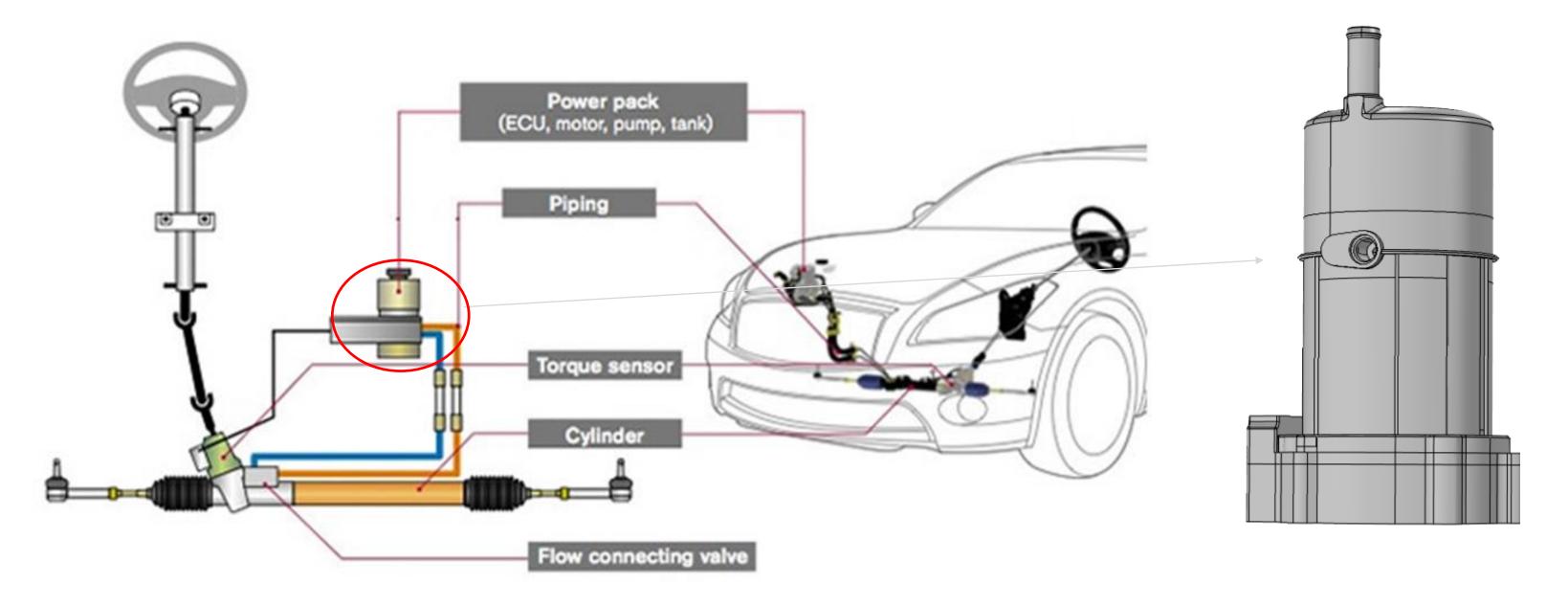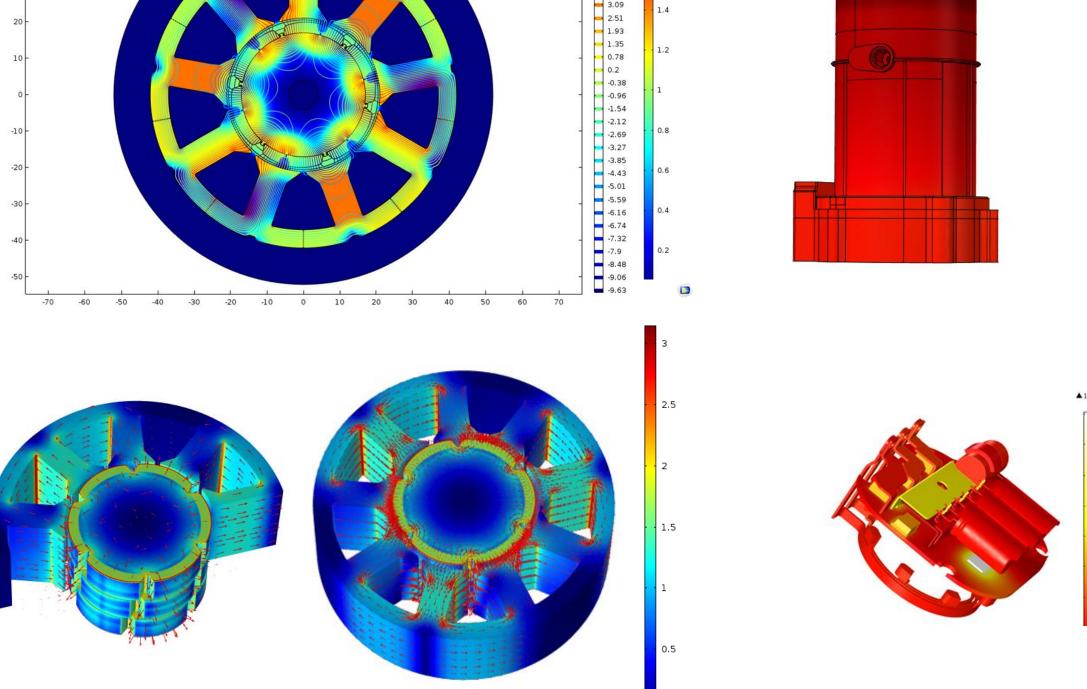# A Virtual Product Development Environment for Electronic Hydraulic Power Steering Pump via Multi-Physics Modelling

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Introduction: Presented is a multi-scale FEA framework of electric hydraulic power steering(EHPS) pump virtual development environment. EHPS pump is a key and complicated component which requires long development time in a typical new passenger vehicle program.
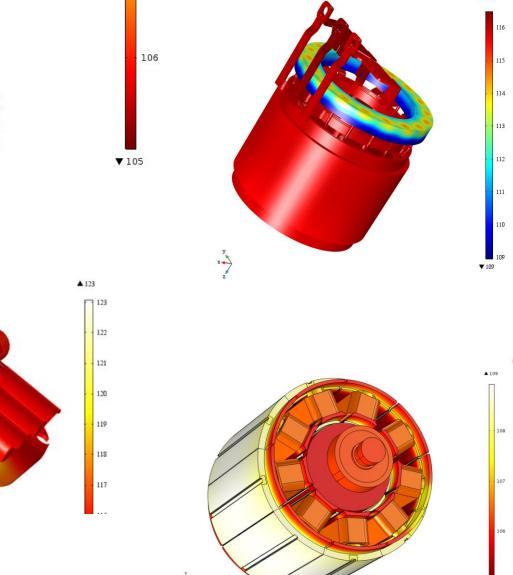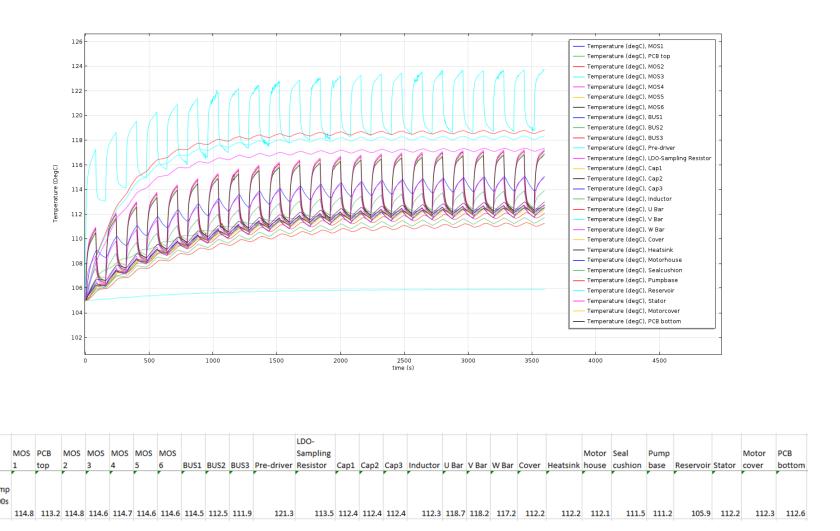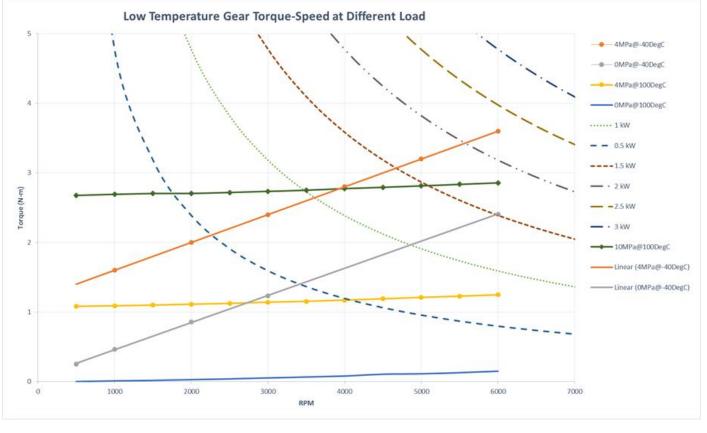

Figure 1. EHPS pump system in a passenger vehicle

Computational Methods: The EHPS pump model has three major components, the external helical gear pump, electronic controller, and PM motor. First, the hydraulic helical gear pump has been accurately solved[1], then the system level simulations are carried out in COMSOL for acoustic, mechanical, electrical magnetic, and thermal coupled analysis. All material properties and boundary conditions are optimized and confirmed by a multiscale modelling methods and validated in bench and vehicle tests. The simulation frame work can address most major engineering issues and significantly reduce development time..

Figure 2. CFD governing equation and results

Results: The pump system level simulations carried out by coupled COMSOL Multiphysics and results are used to identify product performance and validate design.

Figure 3. 2D and 3D Motor   **Figure 4**. Pump thermal

Table 1. Rise temperature   **Figure 5**. System performance

Conclusions: A Multiphysics modelling based virtual product development environment for EHPS pump by COMSOL is established. It can be expanded to many other industry applications. Future work is to apply the model to more pump product.
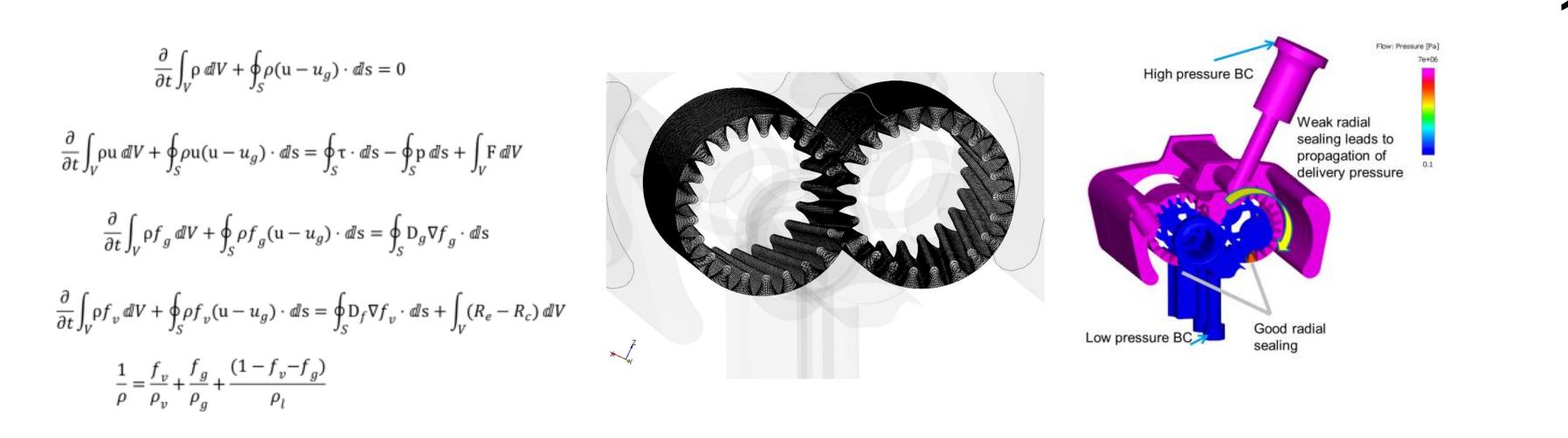
References:

1. F. Qi *et al*, A CFD Study of an Electronic Hydraulic Power Steering Helical External Gear Pump: Model Development, Validation and Application, SAE International Journal of Passenger Cars – Mechanical Systems, April 2016 vol. 9, no. 1 346 - 352 (2016)