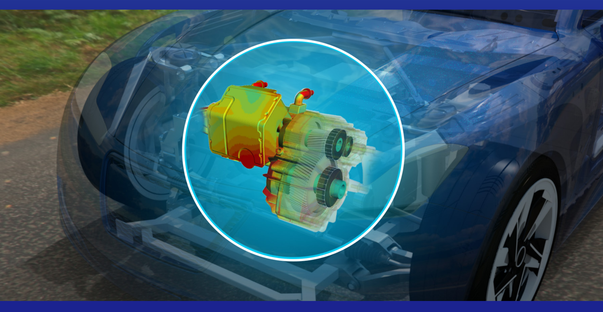
# OPTIMIZING YOUR ELECTRIC DRIVE DEVELOPMENT THROUGH MULTIPHYSICS SIMULATION

*Get five technical papers that provide insight into achieving greater Efficiency, Reliability and Performance*



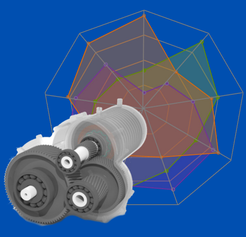
Successful electrical drive development is multiphysical in nature. Engineers need to address intertwining, often conflicting characteristics such as thermal and mechanical requirements, electromagnetic performance, durability, noise and vibration control, as well as lubrication requirements.

Multiphysics simulation enables engineers to predict the behavior of multiple design alternatives in all possible scenarios. It allows them to make the best decision more quickly in order to achieve optimal Electric Drive development before final prototype validation.

## MULTIDISCPLINARY OPTIMIZATION

*Finding the best trade-offs for Electromagnetic Performance, Strength and Stiffness*

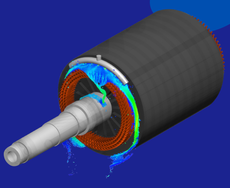
Identifying a good, or even feasible, design for an electric machine requires analyzing a huge number of design options and understanding the effect of each parameter on varied and often conflicting KPIs. We present an efficient workflow for design space exploration and optimization, consolidating the electromagnetic and mechanical domains, using a single parameterized model.

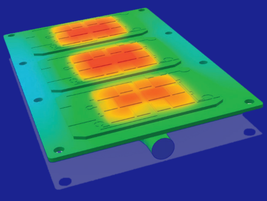


## THERMAL MANAGEMENT

*Controlling Heat for Reliable Performance*

Oil cooling is one of the methods used to cool the stator windings of an electric motor. It presents a complex fluid dynamics and heat transfer simulation problem, as the scales of the dynamic and thermal flows are very different. We showcase a decoupled process of high fidelity multi-phase fluid simulation capturing the state of the coolant, followed by thermal simulation to predict





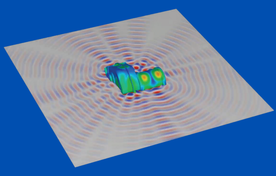
### *Sustaining High Power Densities with Thermal Reliability*

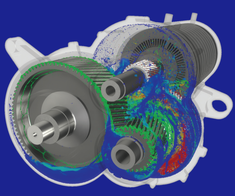
A reliable power electronics system is critical to the proper functioning of an electric vehicle. We show how to determine the power electronics system's exact electrical and thermal characteristics. By coupling the 1D system behavior model which computes average power losses in the electrical components with the 3D fluid conjugate heat transfer analysis, the spatial temperature profile of the power

## NOISE AND VIBRATION MITIGATION

*Ensuring Passengers' Acoustic Comfort*

Accurate prediction of vibrations and noise generated by the electric drivetrain requires multidomain analysis. We present a coupled framework that integrates electromagnetic, multibody and acoustic analyses. Automated model updates and process execution can dramatically reduce the time and effort needed to analyze multiple alternative designs.





## LUBRICATION

*Achieving Longer Service Life*

For proper lubrication of the critical components like bearings and gears, the oil level in the electric drive system needs to be optimized for sufficient surface coverage and minimum induced drag torque. We show how assessment of the lubrication performance can be carried out using fluids simulation. Lattice Boltzmann technology enables high fidelity prediction of the

MULTIPHYSICS SIMULATION empowers engineers to accurately assess the interactions and interdependencies within complex e-drive systems, accelerating innovation and increasing drive quality while reducing development costs.

**Learn more about how simulation solutions can improve your e-drive development process:**

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