Detroit Engineered products (DEP), is an engineering services, product development, software development, consulting and talent acquisition company. Since its inception in 1998 in Troy, USA, DEP is now a global company with footprints in Europe, China, Korea, Japan, and India. DEP uses the accelerated and transformed product development process, accomplished by utilizing our proprietary platform, DEP MeshWorks, which rapidly reduces the development time of products for all segments. The MeshWorks platform delivers tool sets that accelerate virtual validation activities associated with powertrain development across all stages for both convnetional and electric powertrain.

Several tools in MeshWorks have been created with deeper understanding of the needs in a powertrain engineering team. Tools like rib addition, feature removal, model checker, fuse welding, wall thickness reduction options, design space building tools and other model assembly tools have accelerated the way engineers perform model changes for what if studies and optimization.

DEP's IC sensor (In-Cylinder) offers comprehensive portfolio of combustion analysis to the engine design and testing teams in terms of real-time gathered data and make decisions considering emissions, combustion, timing, pressure pattern and performance parameters. This is applicable for single and multiple fuel engines.

The DEP TRIO of IC Sensor, MeshWorks tools and proven technological processes like MDO can significantly add value to Powertrain Engineering.

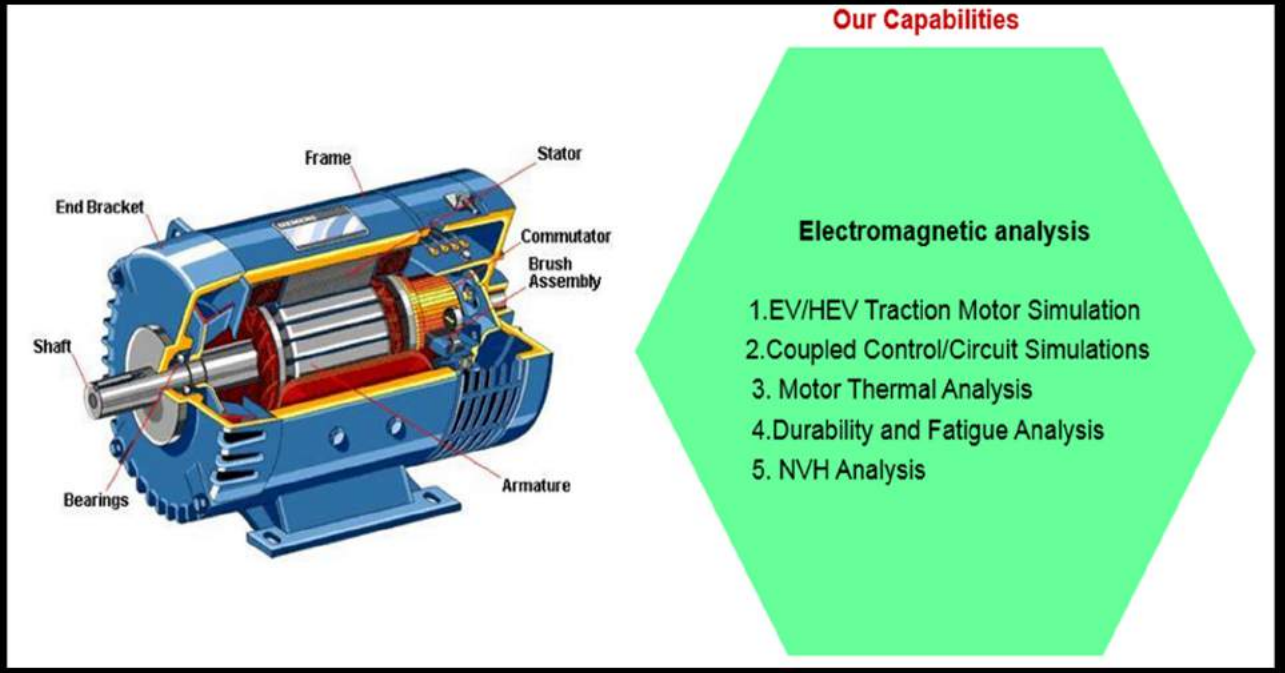
DEP
Smarter solutions. Realized.

ELECTRIC MOTOR SOLUTIONS

- Motor represents a major cost, and most automotive OEMs invested heavily in developing their own motor hardware. But EV becoming the future of transportation, a change of course is required in the designing process which starts all the way from scratch for the development of motor/generator.

- The EV/HEV initiatives are facing lots of design challenges because of increasing dependency on electrical components and overall complexity, coupled with short design cycles.

- Capability of DEP includes, calculating the induced voltage, load torque, cogging torque, inductance, flux linkage, losses (iron, copper, and magnet), parameter sensitivity, equivalent circuit model extraction, heat generation, temperature distribution, stress, vibrations, radiated sound, magnetization, demagnetization, and skew effects.

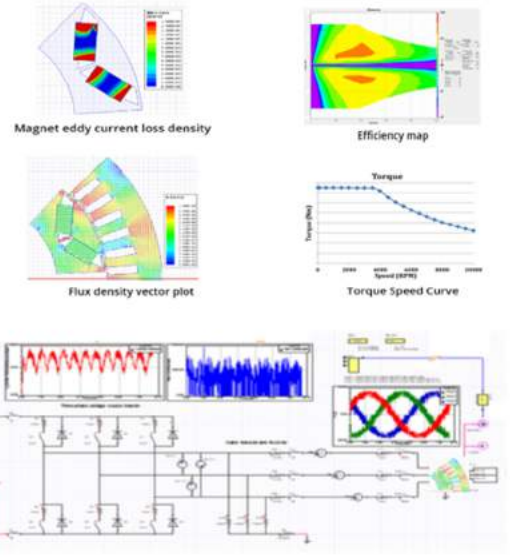


EV/HEV Traction Motor Simulation

- DEP's traction motor simulation is a perfect solution for today's automotive engineers whose optimization needs include efficiency, size & cost along with NVH, Reliability & Durability.
- DEP's accumulated knowledge and experience in motor design, the various mechanical, fluid dynamics, thermal, electrical and electromagnetic related secgments suites various complex requirements.

Coupled Control/Circuit Simulations

- Building hardware is a great art that requires time and lot of procedures & guidelines. But evaluating the machine model by connecting them to circuit model is the new extraordinary experience that DEP can provide.
- The analyses are performed by linking to power electronic simulators such as Simplorer and MATLAB/Simulink. The coupled simulation technique is developed based on the finite element method. The circuit simulation is mainly devised for improving design capability and efficiency.

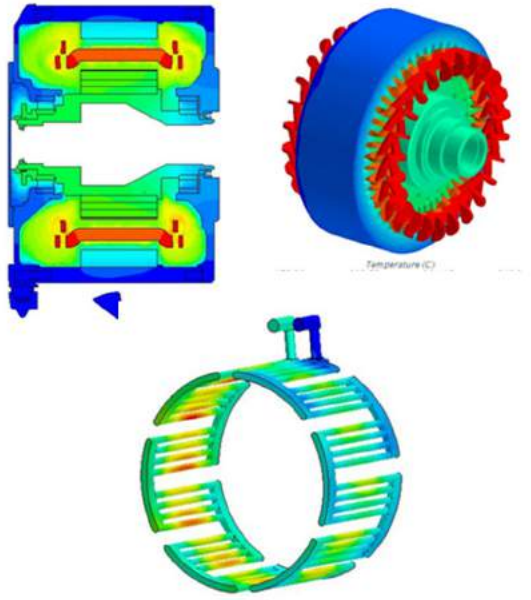


FEA+Circuit (co) simulation

Motor Thermal Analysis

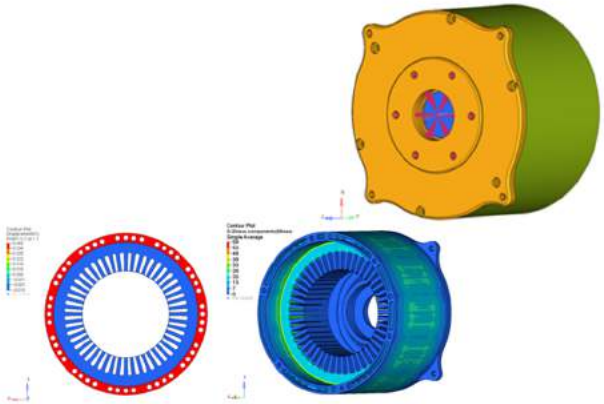
- Temperature is an important factor that affects the performance of electric machines. In order to develop smaller and more efficient electric motors, there is a need to carry out more thermal analysis in parallel with the traditional electromagnetic design.
- By employing computational fluid dynamics (CFD) while doing motor design, one can accelerate the development, achieve better motor cooling and also higher efficiencies. Conjugate heat transfer (CHT) analysis on motor will help in understanding the heat loss to components, coolant and atmosphere. Optimized flow path can be designed based on the CFD results, which helps in improving life of the motor.
- Motor thermal analysis are done as follows:
  - 3D Induction motors analysis for mild hybrids
  - 3D PM motor for full hybrid/ EV's
  - 1D AMESIM / GT Suit model for system simulation

Temperature Plot



Durability and Fatigue Analysis

- Fatigue and durability analysis is the test of time for structural parts that operates over and over, day after day. Mainly this analysis aims to explain how mechanical material behavior relates to the design of structural machine components.
- Fatigue and durability analysis involves time, because failures are progressive in nature and mostly depends on local stress scenario since it is prone to localization also it various based on the impact of working or fluctuating loads . Loads refer to any physical quantity that reflects the excitation or the behavior of components that form a system over time. The most typical loads are forces, torques, stresses, strains, displacements, velocities and accelerations. Other sort of loads may be pressure or flow in hydraulic devices, rotational speed, temperature, or even state variable values in electronic control unit. Computer simulations determine how well the particular part will hold up during cyclic loading in stipulated time without much effort & energy. These calculations incorporate all data regarding materials, environmental conditions and specified constraints too.
- DEP's capabilities for lifetime assessments ranges from basic tools with simplified load assumptions to advanced applications that targets specialized engineering-analysis tasks. The basic fatigue and durability analysis done by DEP can provide an elaborate stress analysis to avoid under- or over-designing of products by simulating actual loading conditions and it helps in comparing designs or design options. Eventually the test result states the service life until damage is sustained.



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