ELECTROMAGNETIC SIMULATION ON THE 3DEXPERIENCE PLATFORM

Electromagnetics (EM) is the field of physics concerned with electric and magnetic fields. The foundations of this field, Maxwell's equations, were laid over 150 years ago, but the solutions to these equations are still crucial to understanding the behavior of any product with EM components, from a telephone to a particle accelerator.

More broadly, there are numerous connections between EM and other fields of science. Motors and magnets produce forces and torques. Electric currents generate heat, which implies a link to thermodynamics. Electronics rely on the properties of semiconductors described by solid-state physics, while batteries produce a voltage due to chemical effects. EM is, therefore, a key part of the multiphysics simulation tool box.

CST helps engineers meet the challenge through our complete technology for 3DEM approach to simulation. We built a platform for the EM space with a large number of general purpose and specialized EM solvers, the ability to hybridize them, and to consider thermal effects and mechanical stress. This allows users to simulate complex systems with many components and consequently many physical effects in a straightforward workflow, without the costs and overhead time associated with switching between different software applications.

"Since joining the SIMULIA family, we've been able to take this further with CST POWER'BY **3D**EXPERIENCE," says Peter Thoma, Managing Director for Research & Development at CST. "Electromagnetism is just one field of physics, and as devices become smarter and more connected, their EM properties are increasingly entangled with other considerations such as mechanical performance, material properties, aerodynamics and product design. The **3D**EXPERIENCE platform provides software solutions that allow collaboration for all these disciplines."

THE FUTURE OF TRANSPORTATION AND MOBILITY

The rise of autonomous vehicles and electric mobility demonstrates the importance of EM and multiphysics simulation. A typical autonomous electric vehicle has numerous components and subsystems interlinked in a complex network of interdependencies, and there are numerous trade-offs made in order to optimize vehicle performance. Minimizing the electromagnetic inference (EMI) emitted by the device while ensuring immunity to external EMI is one of the key considerations.

Let's start with the battery. Its electrochemical properties need to be balanced against its thermal safety and its crashworthiness. The **3D**EXPERIENCE platform enables access to the BIOVIA Materials Studio, to simulate the chemistry and thermal runaway of the battery, and other SIMULIA applications to calculate the structural integrity. Wireless battery charging will increase the usability and acceptance of electric vehicles (EV). Electromagnetic simulation helps to improve efficiency and operational safety of charging devices and procedures.

An autonomous car needs to be aware of its surroundings. There are navigation systems such as GPS, GLONASS and Galileo to determine the current position and plan the route to the destination. The immediate environment of the vehicle can be monitored by radar systems. Vehicle-to-vehicle (V2V) and vehicle-to-everything (V2X) communication systems gather information about potential threats and optimize traffic flow, enabled by the 5G communication standard that powers the Internet of Everything.

Electric pulse on a cable harness inside an electric vehicle