Case Study

"Building effective wireless power solutions requires a profound understanding of antenna performance and radio frequency wave patterns. Powerful computational simulation tools, like ANSYS HFSS, enable Nikola Labs' engineering team to rapidly design and optimize transmit and receive antennas that enable high-performance wireless power transfer. At Nikola Labs, we are ushering in electricity's next great act — the practical transmission of power without wires — and the ANSYS Startup Program provides the right tools to help make our vision of the future a reality."

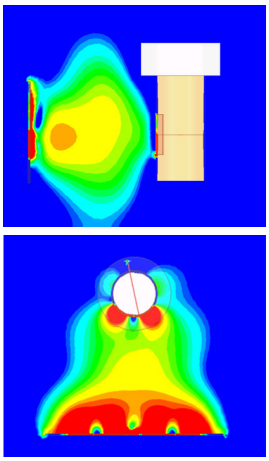
Will Zell
CEO
Nikola Labs

ANSYS Case Study

Nikola Labs Uses ANSYS HFSS to Optimize Wireless Power Transfer

Introduction

Although the basic concepts of far-field wireless power have been understood for some time, they are just now finding practical applications. This is due to two factors: the introduction of increasingly lower-power electronics and improved wireless power transfer performance. The latter is made possible in large part by advanced antenna designs. Developing custom, high-performance antennas that meet the application form factor constraints can be accomplished far more quickly with powerful simulation tools, such as ANSYS HFSS.



ANSYS HFSS was used to design a meandered dipole antenna around an existing RFID tag in a bottle cap.

Challenges

Every application of wireless power is unique in terms of power budget, distance, form factor and environment. Because of these differences and the drive for improved efficiency, it is essential to design transmit and receive antennas specific to each circumstance. Historically, this would be accomplished through building and testing multiple iterations before discovering the optimal geometry and configuration. Simulation tools allow designers to rapidly evaluate designs before committing to fabrication.

Technology Used

ANSYS HF

Engineering Solution

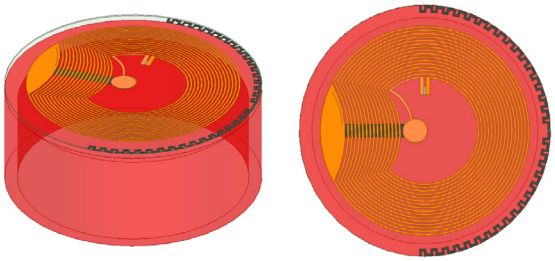
Advanced antenna design must consider all relevant factors, including field strength, geometry, materials of construction and environmental factors. HFSS is a powerful tool with a built-in material database that allows for full-wave simulation and automatic geometry meshing. HFSS also enables engineers to verify that mechanical designs do not interfere with wireless power transfer. The ability to accurately simulate wireless power systems saves time and money associated with building and testing multiple prototypes before arriving at a final design.

Benefits

Like most early-stage, investor-funded companies, Nikola Labs is resource-constrained and must show rapid progress to keep our customers and backers engaged and satisfied. By allowing our engineers to iterate on designs in a complex simulation that accurately reflects real-world conditions, HFSS allows our engineering team to develop creative solutions that meet stringent performance and form factor constraints. Further, HFSS can quickly evaluate the performance impact of manufacturing tolerances to ensure systems will operate reliably as designed.

Company Description

In 2014, Nikola Labs spun out from The Ohio State University's (OSU) world-renowned ElectroScience Laboratory to commercialize wireless power technology invented by Dr. Chi-Chih Chen, who now serves as our company's CTO. Dr. Chen, who is a fellow with both IEEE and AMTA, developed a state-of-the-art system that conveys energy using radio frequencies (RF) waves, which are captured on effective antennas and efficiently converted into direct current (DC) power with advanced circuitry. OSU's foundational patents are licensed exclusively to Nikola Labs.



Using ANSYS HFSS, a close-proximity wireless power system prototype was designed by maximizing the near-field coupling between the transmitter and receiver antennas.

ANSYS, Inc.
www.ansys.com
ansysinfo@ansys.com
866.267.9724