

DEVELOPING SUSTAINABLE MOTORS

DESIGNING E-MOTORS INDEPENDENT OF RARE EARTH METALS WITH ALTAIR SOLUTIONS

About the Customer

Founded in 1999 and based in Piacenza, Italy, Spin is an engineering company focusing on the analysis, design, optimization, prototyping, testing and production of electrical devices and motors. Spin offers its services – including consultancy, design, optimization, and more – to an array of industries, including the automotive, industrial, marine, defense, biomedical, aerospace, energy, and home appliance sectors. Spin has been an official Altair reseller since 2016 and uses Altair solutions daily to design different types of electric motors and electromechanical devices.

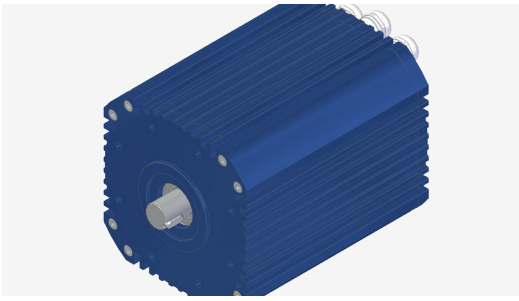


Altair's software solutions provide the perfect toolkit to solve today's design challenges, enabling us to bring new technologies to market in the electric world faster than ever before."

Matteo Betti, technology manager, Spin Applicazioni Magnetiche.



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LEFT: Using Altair solutions, Spin performed electromagnetic, mechanical, and structural analyses as well as thermal simulations. **RIGHT:** Spin's new e-motor represents a new generation of high-efficiency, silent, and rare-earth free synchronous-reluctance motors.

Their Challenge

Permanent magnet motors are widely used in the development of electric vehicles (EVs). However, these devices are based on expensive, hard-to-recycle rare earth materials. Wanting to explore new boundaries in electric motor design and production, Spin started a project focused on replacing rare earths materials in these motors. The company wanted to develop a more sustainable motor without using rare earth-based permanent magnets while still ensuring efficiency and meeting performance targets. To pursue their new approach, the team had to conduct many analyses of the new motor design and needed a tool that allowed them to study, evaluate, and improve every possible aspect of the motor's behavior and performance before building a prototype.

Our Solution

In the development of the new motor, Spin's technical team used a wide range of Altair solutions to achieve their objective of eliminating rare earth materials in the new motor's design. During the pre-designing phase, Spin conducted several studies of various motor configurations to validate performance and establish preliminary designs accurately.

Before proceeding to prototype construction, Spin performed finite element modeling (FEM) electromagnetic analyses using Altair® FluxMotor® and Altair® Flux®. These analyses enabled them to evaluate device performance and electrical parameters, including torque, phase voltage, magnetic flux density, energy losses, and machine efficiency at different operating points.

The Spin team also focused on assessing the motor's mechanical aspects. They employed Altair solutions to conduct structural rotor analysis and vibro-acoustic evaluations. For mechanical and structural analysis, Altair SimSolid®, Altair® HyperMesh®, Altair® Inspire™, Altair® OptiStruct®, and Altair® HyperStudy were utilized for optimization. Additionally, Altair® SimLab® and Altair® HyperWorks CFD® facilitated computational fluid dynamics (CFD) simulations.

Finally, the team executed thermal simulations using Altair® ElectroFlo™, Altair® PSIM™, Altair Activate®, and Altair Compose®. These thermal simulations played a crucial role in verifying performance and ensuring the motor's success.

Results

Thanks to the Altair® HyperWorks® platform and its multiphysics analysis capabilities, the Spin team made significant progress in developing a new, highly efficient product: the synchronous reluctance motor. Leveraging Altair's tools, they seamlessly integrated various design aspects, considering the motor, battery, and inverter for specific market demands. Correlated simulation and bench test data validated the motor's performance and efficiency. With Altair's support, Spin created a sustainable design, meeting performance targets while reducing development time and eliminating the need for rare earth materials.

Learn more at altair.com/electromagnetics-applications/