



CASE STUDY /

## A New Era of Axial Flux Motor Technology for Electric Vehicles – Magnax

“The design and development of a new axial flux motor technology requires a mix of specialized knowledge and powerful software tools. Ansys software is an excellent fit for this purpose.”

**Daan Moreels**  
Co-founder / Magnax

The development of a new motor design comes with a wide range of engineering challenges. The behavior of the motor must be researched and modeled to obtain a qualitative and manufacturable product design. Simulations are essential in this process to gain technical insights, calculate complex situations and provide guidance in the prediction and validation of physical test results.

## / Company Description

Magnax is building and manufacturing next-generation electric motors based on yokeless axial flux technology. We have developed a unique, proprietary variant of yokeless axial flux machines, which can provide a step change in power density, efficiency, size, reliability, manufacturing resource requirements and cost-effectiveness.

The new technology is used for electric motors in electric vehicles with a high power density and efficiency requirement. The patented axial flux technology is backed by six years R&D (in collaboration with University Ghent) and three years of prototyping.

## / Challenges

Our yokeless axial flux technology has been in R&D since 2008. Compared with traditional motor technology, it has a completely different motor topology. The technology goes through an extensive design-for-manufacturing process and evolves into market-ready products, which offer a step change in efficiency, size, reliability, manufacturing resource requirements and cost-effectiveness. This requires extensive research into the optimization and manufacturability of the design in order to obtain a performant, cost-effective and lightweight motor.

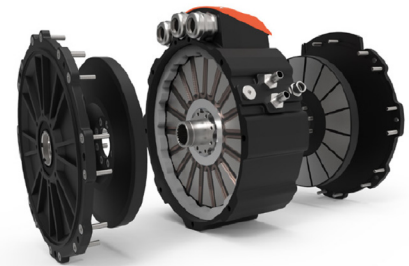
In the technology commercialization process (especially with respect to hardware), time to market is crucial. The decision to use simulation is based on our need to speed up the design optimization process and decrease the amount of physical testing needed to validate different design options. The software must be capable of calculating complex solutions concerning electromagnetic, mechanical and thermal behavior.

## / Technology Used

- Ansys Maxwell
- Ansys Mechanical

## / Engineering Solution

- Simulation of the electromagnetic behavior of the motor estimates the efficiency and losses of the design.
- Analysis of the mechanical loads on the motor helps optimize the shape and material of the components.
- Modeling the thermal behavior of the motor determines the heat flux and optimizes the cooling system.



Exploded view of the Magnax yokeless axial flux motor. Displayed are 18 cores, two rotor discs with permanent magnets and two cover plates (IP67).



## / Benefits

Engineering simulations provides insights and figures that would otherwise have to be obtained through extensive physical testing of different design configurations. This not only saves a large amount of time and money, but also allows for a much more in-depth evaluation of the observed behavior. Our goal is to reduce the development time of our motors to only a few months and bring them into mass production via production partners.

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