



# Research topics



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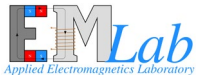
## Axial flux permanent magnet machines

Electromagnetic design and testing of axial flux permanent magnet machines for vehicular and industrial applications:

1. Magnetic equivalent circuit-based model for design of machines with desired application's characteristics;
2. Finite Element Method (FEM)-based investigation for performance evaluation;
3. Experimental tests to verify the manufacturing feasibility of the designed structure and assess the effective devices performance.

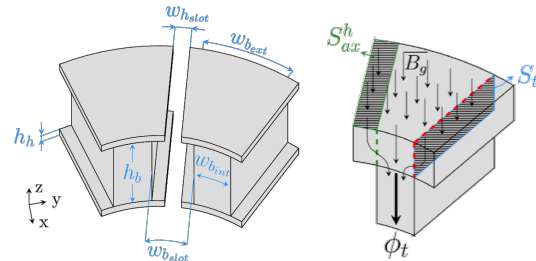
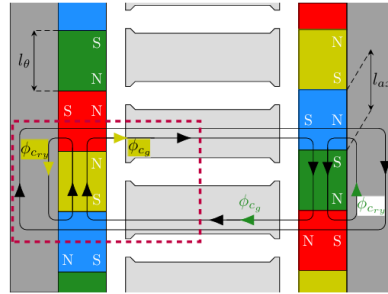
## Rotary Transformers

Wireless power transmission system for rotary winding feeding. The analysis is based on Finite Element (FE) simulations for the electromagnetic, thermal, and mechanical performance investigation of rotary transformers.





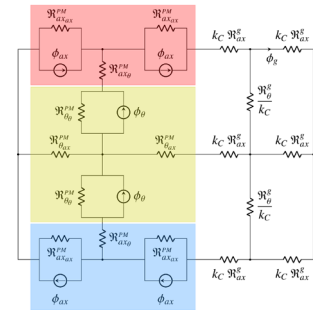
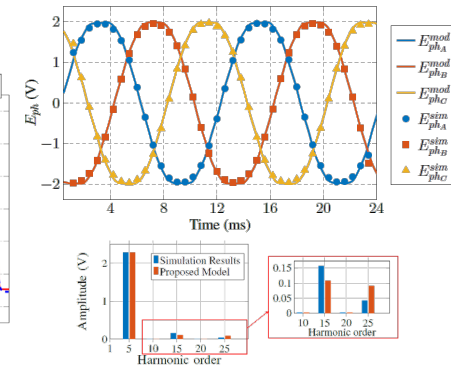
Starting for the desired application's characteristics (i.e., nominal torque and speed, and available space), the model determines the main geometrical dimensions of stator and rotors and the motor performance.



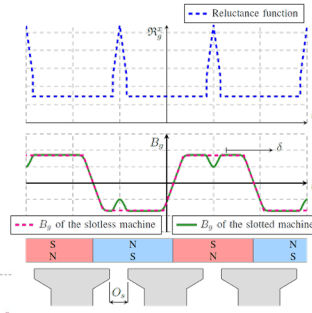
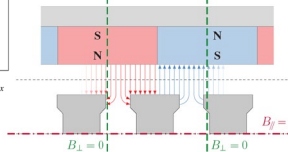
The efficiency, torque and no-load induced voltages are evaluated to verify the design constraints match

The ferromagnetic yokes are designed starting from the airgap magnetic flux density derived using the magnetic equivalent circuit. The magnetic saturation avoidance is imposed to determine the yokes' cross-section

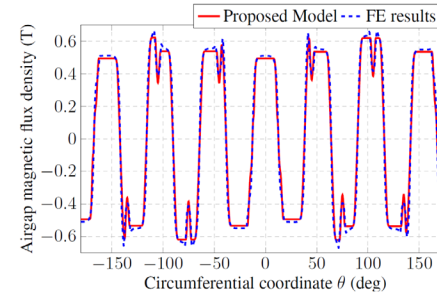
## No-load induced voltages



## Slot effect investigation



### Airgap magnetic flux density in load conditions



N. Gori et al, "Electromagnetic Design Algorithm for Axial Flux Permanent Magnet Machines," in *IEEE Transactions on Energy Conversion*, vol. 41, no. 2, pp. 1610-1624, June 2026

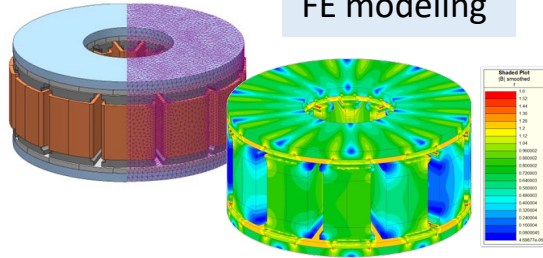


# Axial flux permanent magnet machines

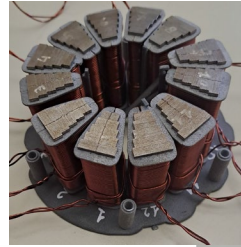
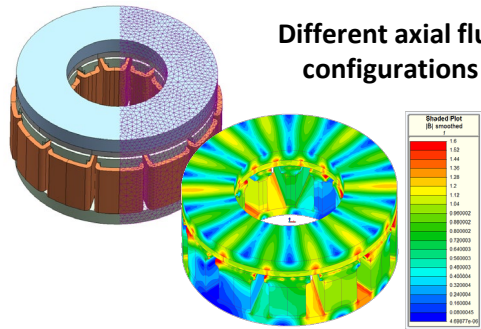
## Design and test of axial flux permanent magnet motors

Assessment of prototype performance using different experimental test benches selected according to motor size

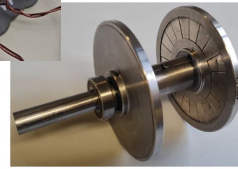
FE modeling



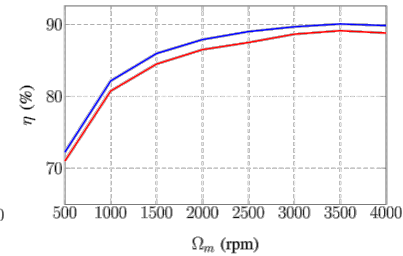
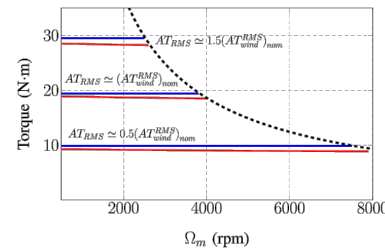
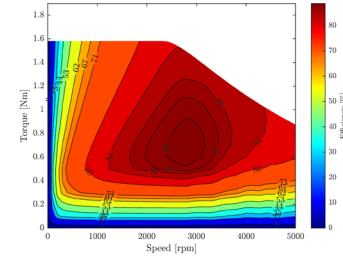
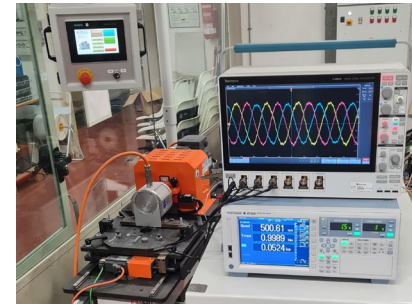
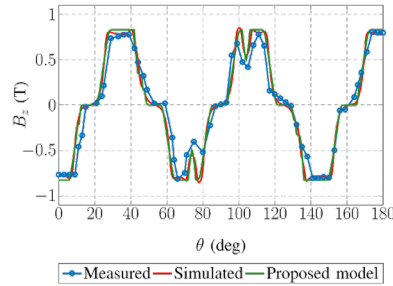
Different axial flux configurations



Prototype assembly



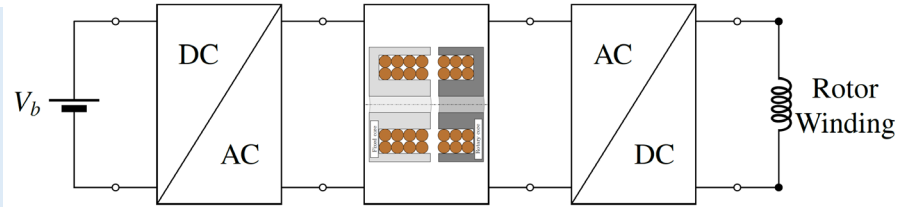
No load airgap magnetic flux density



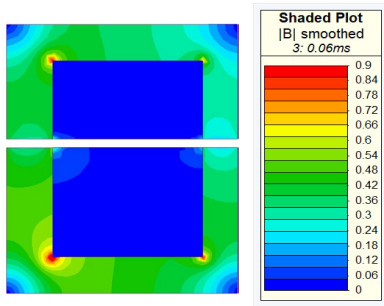


# Rotary transformers

Wireless power transmission between a fed fixed core and a rotary one integral with the rotor shaft: no needs for sliding contacts, avoiding friction.

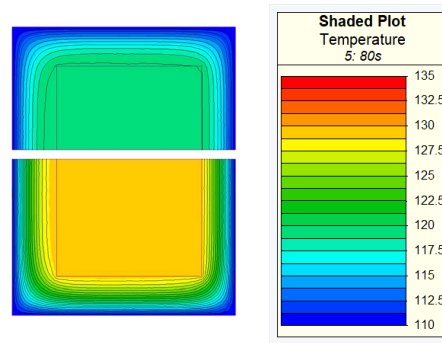


## Electromagnetic analysis



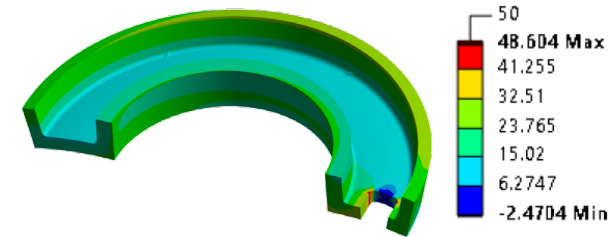
Derive the transmitted power

## Simplified thermal analysis



Investigate the temperature of the hottest points

## Simplified mechanical analysis



Study the mechanical integrity of the rotary core while it spins