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Axial Flux Motor

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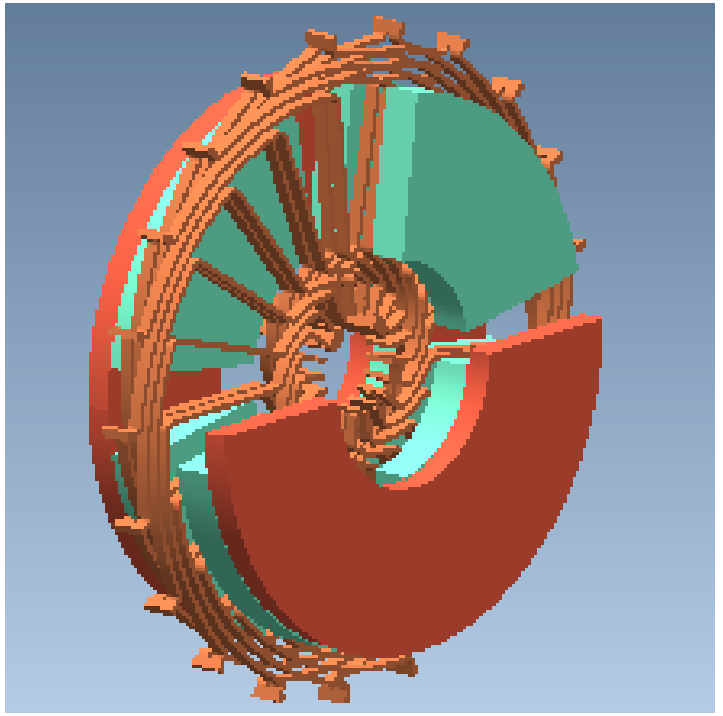
An axial flux motor is different from conventional electric motors due to the different path of the magnetic flux. In conventional motors, the flux flows radially through the air gap between the rotor and the stator.

However, in this motor the flux flows parallel to the axle of the motor. This type of rotor is often referred to as a pancake rotor and can be made much thinner and lighter than other types. When quick changes in speed are required, axial flux motors are an ideal choice.

This particular 4-pole disc wave winding is taken from the book ”Direct Current Machines” by M. G. Say and E. O. Taylor. It was simulated using Simcenter MAGNET.



Single Segment of Winding

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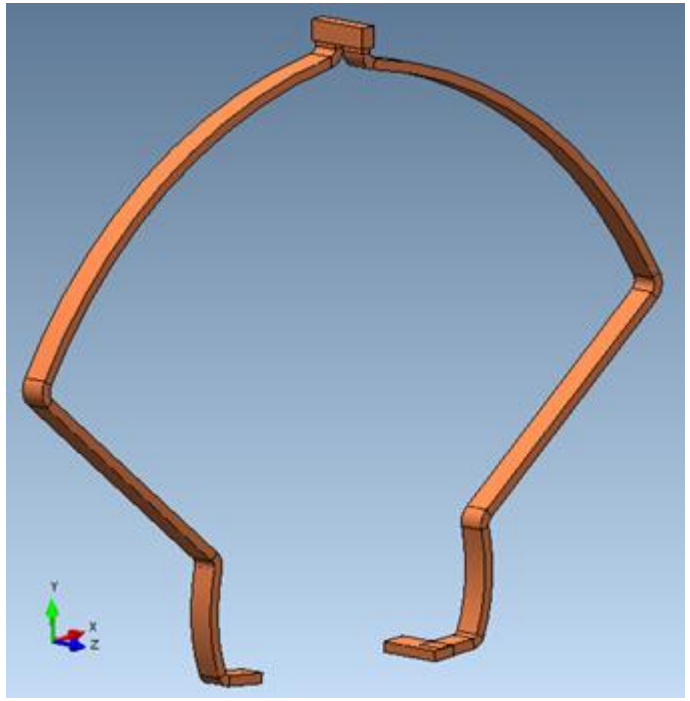
Connecting the 21 segments to form the complete winding is made much easier with Simcenter MAGNET's capability to automatically determine the conducting path between coil terminals.

For simulation purposes, all the winding segments in this motor are treated collectively as just one coil component defined by two terminals, one on the end of each brush.



Current Density Magnitude in the Axial Motor

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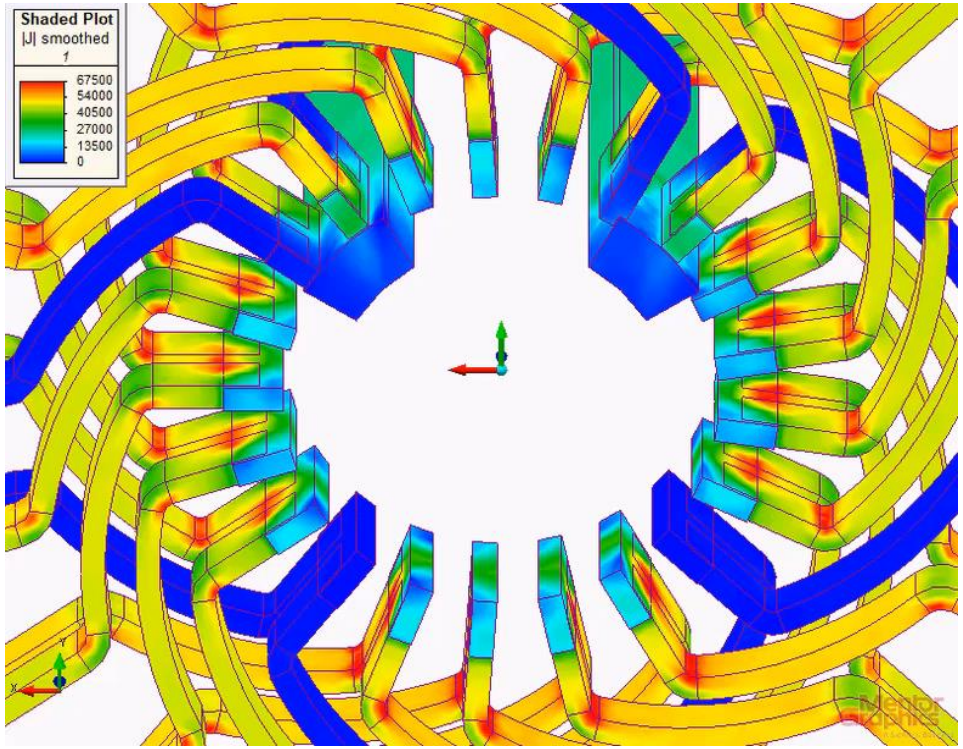
This animation of the changing current density magnitude demonstrates the automatic commutating action of the brushes.

Simcenter MAGNET simulates the conductor at each position of the rotor to determine where the current will flow.

Note how the current density is higher at the corners due to the fact that in this motor the rotor conductors are made from solid copper rather than stranded wires.



Determining the Optimal Operation of the Motor

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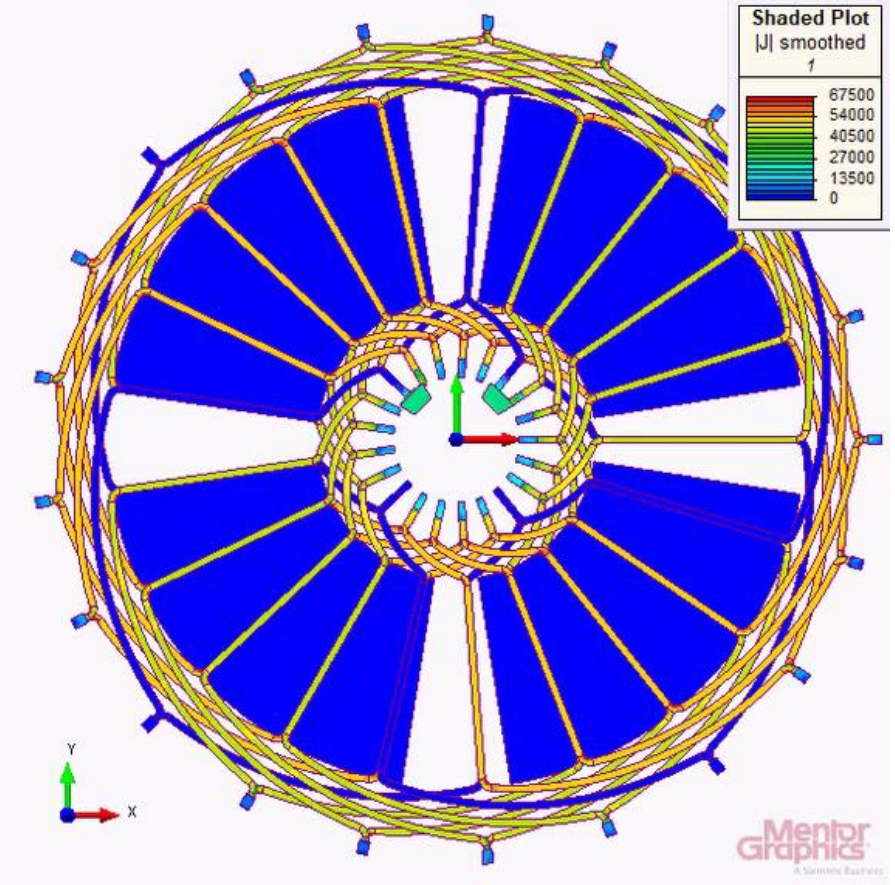
The size and location of the brushes and sectors is critical to the optimal operation of the motor.

This animation shows when each coil switches off in the gap between magnet poles before the current direction reverses.

The timing of this motor could be improved to maintain a uniform current density over the cycle.



Path of the Current Around the Rotor

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The current goes through a very convoluted path while making its way around the rotor, as shown in this image.