



## Axial Flux-Switching Permanent Magnet Machine for High Speed Operation

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**WARF: P150249US01**

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**The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a redesigned axial FSPM machine that boosts efficiency and is ideal for high speed applications.**

### Overview

High speed electric machines are needed in many applications including HVAC, industry, flywheels, fans, fuel-efficient vehicles, aircraft and much more.

Flux-switching permanent magnet (FSPM) machines are a promising option because they offer better cooling, simpler rotor construction and reduced reliance on rare earth materials. However, they have difficulty reaching high speeds. This is because current designs require high fundamental frequency to turn the rotor and allow the motor to operate. Such high fundamental frequency may not be attainable with today's power electronic converters.

There are two FSPM topologies: radial and axial. In general, axial topologies have a more compact footprint and are ideal where space is at a premium, such as in-wheel vehicle drives.

### The Invention

UW-Madison researchers have developed a new axial FSPM machine that can be run at high speed with less fundamental frequency required, therefore overcoming one of the largest barriers to adoption. The new design features innovative axial flux topologies with offset rotor and/or stator structures.

### Applications

- Compressors, fans, pump motors, traction motors in hybrid and electric vehicles, aerospace motors and generators, and more

### Key Benefits

- Ideal for high speed applications (also for medium and low speeds)
- Achieves up to 60 percent reduction in fundamental frequency
- Reduces core losses, copper losses and inverter switching losses
- Increases efficiency and power density

### Stage of Development

The researchers have performed simulations and plan further prototyping.

### Additional Information

### Related Technologies

- [WARF reference number P140405US01 describes the researchers' similarly innovative radial flux design.](#)

### Tech Fields

- [Engineering : Electric machines](#)
- [Engineering : Engine technologies](#)

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