



## Lower Cost Motor for Electric Vehicles

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**WARF: P120242US01**

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**The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a variable flux intensified motor design that obtains stable torque without expensive permanent magnet material.**

### Overview

A class of electric machine called an interior permanent magnet (IPM) can be used as a motor inside the wheel rotor of electric or hybrid-electric vehicles to power the wheels. One of the largest costs in an IPM machine is the thick, high-coercivity magnets. This material cost has doubled in recent years.

To enable a lower cost motor, UW–Madison researchers have pioneered a design that uses a Flux Intensified (FI) control approach, rather than the conventional Flux Weakened (FW) approach. Their design uses less permanent magnet material and, unlike typical FW systems which are made to run at high speed and low torque, is applicable to new vehicles that run at low/modest speeds but require higher torque.

### The Invention

Building on their work, the researchers have developed an improved FI-IPM machine and control method. The new design employs thin, low-coercivity magnets and allows re-magnetization using the stator winding and system power control. Magnetic force is reduced, and voltage is limited in high-rotation zones in which normal motors require flux weakening control. Re-magnetization is performed in zones that require low rotation and high torque, and the desired magnetic flux is obtained in the magnets.

### Applications

- Improved IPM for hybrid/electric vehicles
- Installed in two or all four wheels

### Key Benefits

- Needs less or no rare earth/permanent magnet material
- Less sensitive to demagnetization
- Improved stability
- Higher torque production capability
- Variable flux characteristics superior to existing designs
- Lower loss operation

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The researchers have developed a functioning prototype, which has  provided results in agreement with computer modeling simulations.

## Additional Information

### Related Technologies

- [For more information about the researchers' cost-saving motor innovations, see WARF reference number P120243US01.](#)

### Tech Fields

- [Engineering : Electric machines](#)

For current licensing status, please contact Michael Carey at [mcarey@warf.org](mailto:mcarey@warf.org) or 608-960-9867

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