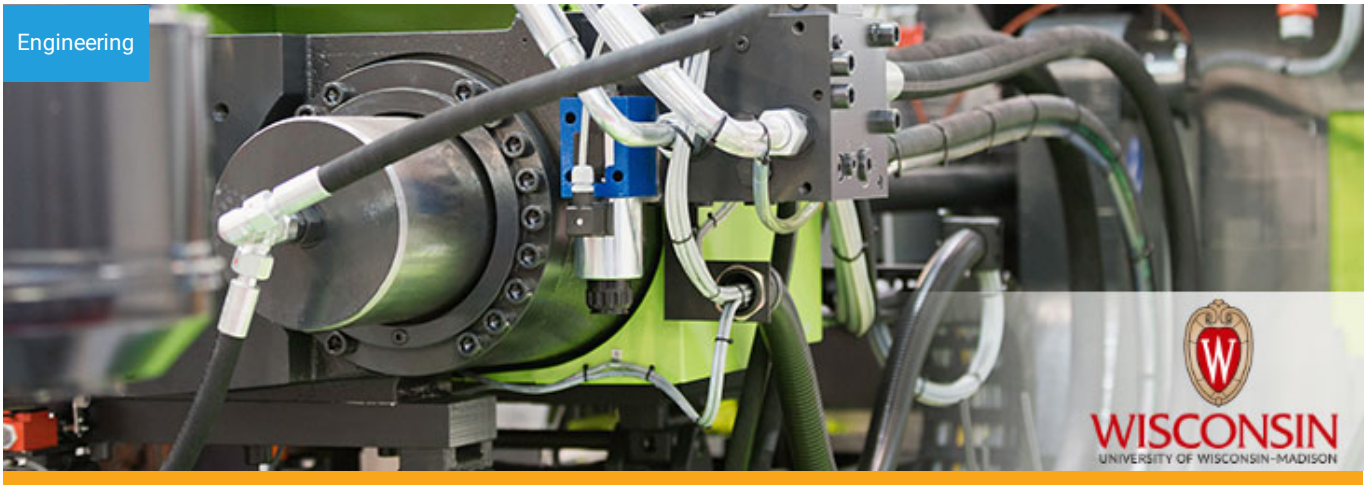
Engineering



Motor for Electric Vehicles Solves Load/Loss Tradeoff

View U.S. Patent No. 9,692,265 in PDF format.

WARF: P120243US01

Inventors: Robert Lorenz, Natee Limsuwan, Takashi Kato

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing an interior permanent magnet machine design that minimizes loss without compromising torque.

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. Conventional IPM machine designs place an air gap or other barrier by the two sides of the magnet to minimize *flux leakage* (an undesirable property) while maximizing a quality called *flux linkage*.

However, this ultimately results in a tradeoff between load, loss and torque. For applications that run at low load some of the time and high load at other times, there has been no satisfactory solution until now.

The Invention

UW–Madison researchers have developed a new IPM design methodology that offers a solution to conventional performance tradeoffs.

The new design features variable flux linkage characteristics to reduce iron and copper loss under low and high load conditions, respectively. The design does not compromise torque capability and exploits flux leakage already present in every PM machine. In other words, compared to previous IPMs, this technology is able to convert a weakness into an advantage.

More specifically, the rotor geometry is designed such that flux leakage can be shifted to cross the air gap and become desirable flux linkage when stator current is applied. It can be increased or decreased as needed based on load conditions.

Applications

- Improved IPM design for hybrid/electric vehicles
- Widespread industrial motor drive applications (e.g., fans, pumps, appliances, etc.)

Key Benefits

- Ability to leverage flux leakage into desirable flux linkage
- Improved versatility and efficiency
- Reduced loss
- Enhanced torque production
- Lower energy consumption (esp. in duty-cycle based applications)

Stage of Development

The researchers have produced simulation data and incorporated several aspects of the new technology into a prototype.

Additional Information

Related Technologies

- For more information about the researchers' complementary motor innovations, see WARF reference number P120242US01.

Tech Fields

- Engineering : Electric machines

For current licensing status, please contact Michael Carey at mcarey@warf.org or 608-960-9867