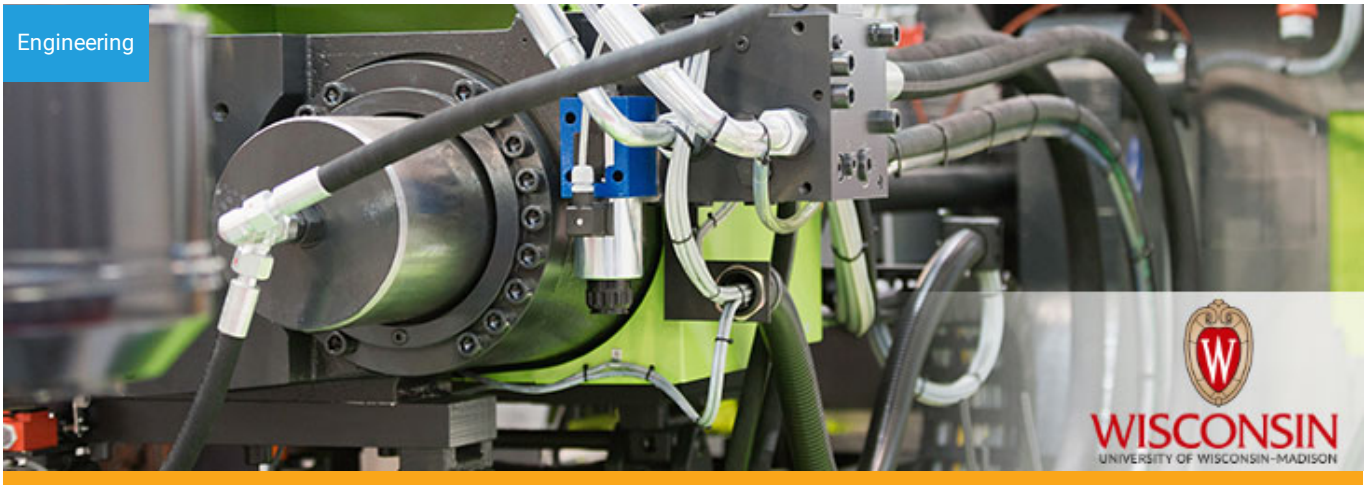
Engineering



Wound Field Synchronous Machines with Enhanced Saliency, Performance

View U.S. Patent No. 10,784,727 in PDF format.

WARF: P170015US01

Inventors: Thomas Lipo, Wenbo Liu

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a modified rotor structure for salient pole WFSMs that improves output power and torque production while reducing loss.

Overview

Permanent magnet (PM) machines are used in today's hybrid and electric vehicles due to their ideal performance characteristics. However, due to cost uncertainty and overseas sourcing, other types of machines are being explored to determine if they can offer similar performance without the need for permanent magnets.

Salient pole wound field synchronous machines (WFSMs) are a potential alternative. Traditionally used in generators, they share the same operating principles as PM machines, offer similar torque capabilities and are free of permanent magnet material. They also offer potential advantages in variable speed applications such as traction, i.e., hybrid and electric vehicles. However, there are disadvantages to this type of machine, namely slip rings and brushes.

Improving saliency could expand the end applications of WFSMs into the hybrid/electric motor space and replace high cost PM machines.

The Invention

UW–Madison researchers have designed a modified rotor structure for salient pole WFSMs that enhances saliency and leads to better performance (peak motoring power/torque capability) using the same amount of input current.

Compared to conventional designs, the new rotor structure features a flux barrier gap made of a low cost polymer that enlarges the reactance Xd - Xq, differential between rotor axes. Based on the particular end use, three different barrier designs could be employed (single barrier, multilayer barrier or axial laminated).

Applications

- Motor and generator manufacturing; hybrid/electric vehicles

Key Benefits

- Enhanced saliency
- Maximum torque capability increase
- Reduced copper/iron loss during both part load and high speed operation
- No need to increase reactive current for field weakening
- Similar in size and volume to existing rotors

Tech Fields

- Engineering : Electric machines

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