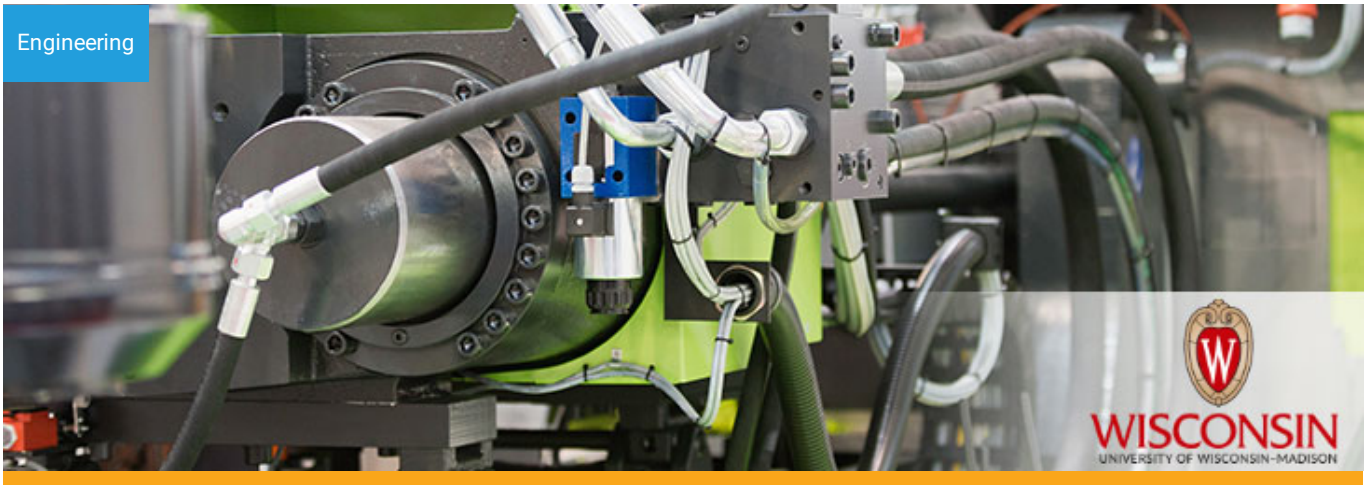
Engineering



New Flexible Mechanical Structure for Improved Wireless Power Transmission

View U.S. Patent No. 8,736,137 in PDF format.

WARF: P110321US01

Inventors: Daniel Ludois, Justin Reed, Kyle Hanson

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a wireless power transfer technique that eliminates a number of reliability and maintenance issues associated with electromechanical power transmission.

Overview

Permanent magnet synchronous machines are one type of electrical rotating machine (i.e., motor or generator), which are common in hybrid vehicles and wind turbines. Although these machines have a high torque density and efficiency, they use rare earth materials whose extraction and refinement may have a detrimental effect on the environment. An alternative is a wound field synchronous machine, which uses electromagnets rather than permanent magnets on the rotor. These electromagnets require electric current to function and the current must be delivered wirelessly.

Wireless electrical power transmission is a necessary component of many machines with stationary and rotating parts, including household appliances, automation lines, wind turbines, transportation vehicles and electric generators. Other wireless techniques rely on either electromechanical devices such as brushed slip rings or electromagnetic devices such as rotary/translational transformers and resonant inductive methods. Slip rings require maintenance and create dust and arcing, brushes don't work well over a variable speed range, and electromagnetic techniques are bulky, expensive, only operate at a single speed and are unsuitable for traction applications. A new mechanism for wireless power transfer is needed to overcome these many issues with current techniques.

The Invention

UW–Madison researchers have developed a wireless power transfer technique that uses opposing pairs of capacitor plates, eliminating many of the reliability and maintenance issues present in current designs. The design provides a mechanism to power the electromagnets in wound field synchronous machines by which power is transferred to the rotor via capacitive coupling. The device consists of a flexible plate structure and glides on a cushion of air while the system is in motion. The system comprises a rotor including at least one electrical coil, a conductor, an electrical rectifier and first, second, third and fourth capacitor plates. The device may further comprise a power generation circuit providing alternating current power to at least one electrical coil and a capacitance monitor to provide an output signal indicating velocity and/or position of the rotor.

Applications

- Wound field synchronous machines
- Wind turbines
- Generator sets
- Power source for sensors and actuators

Key Benefits

- Eliminates many reliability and maintenance issues in current electromechanical designs
- Provides narrower separation of capacitor plates than any rigid mechanical structure
- Yields very high capacitance values
- Scales with size and is easily controlled
- Easier to construct and maintain than other capacitive slip rings
- Utilizes fewer materials making it more cost effective
- Can be flexibly implemented in a variety of topologies

Stage of Development

A prototype using a computer hard drive as the spinning plate has been constructed for proof-of-concept testing. A subsequent prototype currently is being developed.

Additional Information

For More Information About the Inventors

- Daniel Ludois

Related Intellectual Property

- View Continuation Patent in PDF format.

Tech Fields

- Engineering : Electric machines
- Engineering : Power electronics & control systems

For current licensing status, please contact Emily Bauer at emily@warf.org or 608-960-9842