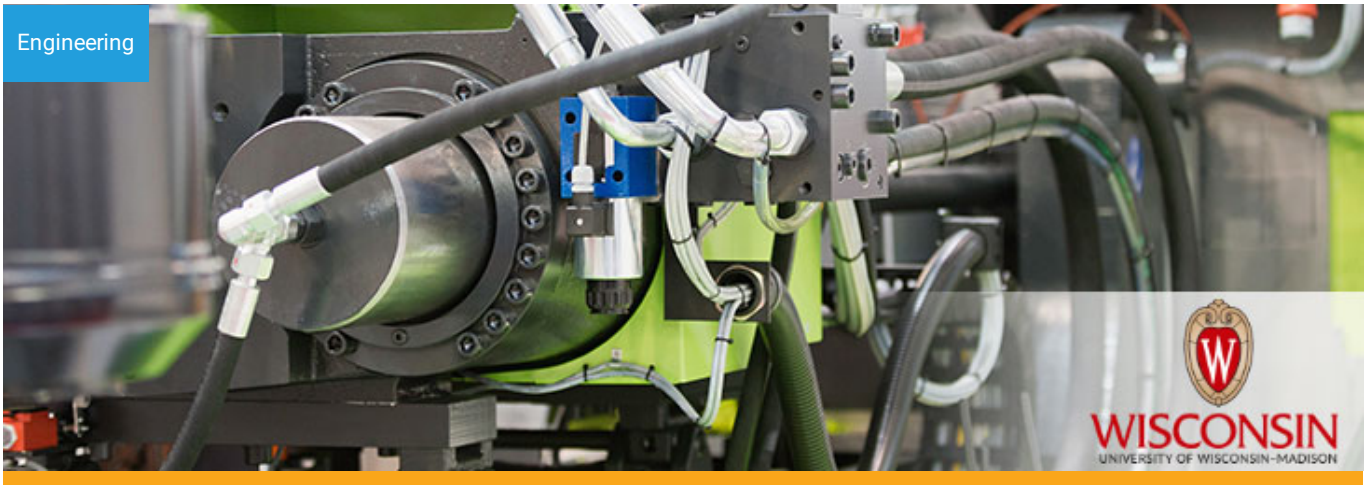


# Brushless Synchronous Motor Utilizing Third Harmonic Excitation for Power Transfer to Rotor

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**WARF: P100315US01**

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**The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a brushless synchronous motor utilizing third harmonic excitation.**

## Overview

Existing power machines provide the ability to capture power from a mechanically rotating source, such as a wind turbine. One example of such power machines is the synchronous motor, which contains a stator carrying an armature winding and a rotor carrying a field winding. The rotor rotates at a supply frequency while the armature winding creates a rotating magnetic field inside the synchronous motor. The magnetic field on the rotor is generated either by current delivered through slip rings and brushes to the field winding of the rotor or by a rotor comprised of a permanent magnet.

A drawback to synchronous machines utilizing brushes and slip rings is that the slip rings and brushes are prone to failure and difficult to maintain. Conversely, machines utilizing a permanent magnet are becoming increasingly expensive due to the scarcity of the raw materials used to form the permanent magnet. A synchronous motor that can generate a magnetic field on the rotor without utilizing brushes or permanent magnets is needed.

## The Invention

UW-Madison researchers have developed a brushless synchronous motor that enables power to be transferred to the rotor without requiring slip rings, brushes or other failure-prone components. Unlike traditional synchronous machines where all windings are connected, in this improved design there are three stator windings, which together generate square waves, and two windings mounted to the rotor. The generated square waves induce a voltage in the first rotor winding to form a plurality of third harmonic coils, which are then applied to the second rotor winding to create a brushless, synchronous motor.

## Applications

- Large synchronous machines such as wind turbines
- Permanent magnet machines such as traction motors

## Key Benefits

- Allows power transfer to the rotor without brushes or slip rings
- More reliable than synchronous machines that utilize brushes or slip rings
- Less expensive than permanent magnet machines



**Tech Fields**

- Engineering : Electric machines

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