Improved Bearingless Switched-Reluctance Motor

Performance is better and design simpler, relative to a prior bearingless switched-reluctance motor.

John H. Glenn Research Center, Cleveland, Ohio

The Morrison rotor, named after its inventor, is a hybrid rotor for use in a bearingless switched-reluctance electric motor. The motor is characterized as bearingless in the sense that it does not rely on conventional mechanical bearings: instead, it functions as both a magnetic bearing and a motor. Bearingless switched-reluctance motors are attractive for use in situations in which large variations in temperatures and/or other extreme conditions preclude the use of conventional electric motors and mechanical bearings.

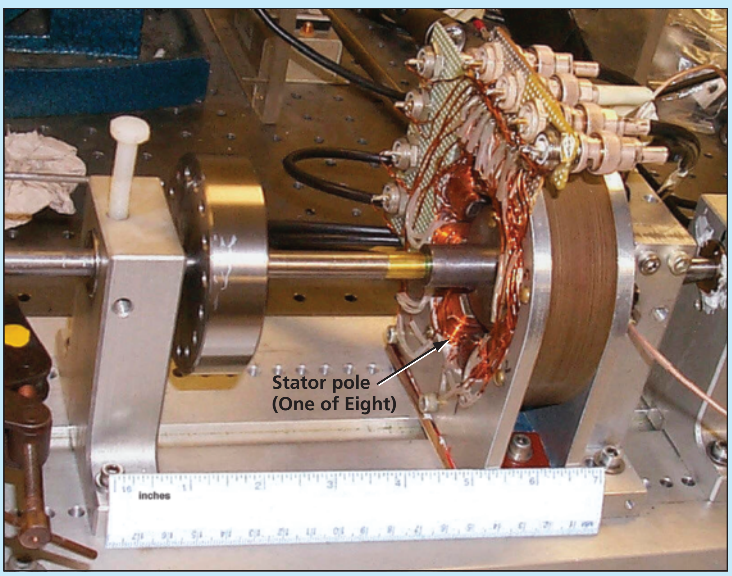
In the Morrison motor, as in a prior bearingless switched-reluctance motor, a multipole rotor is simultaneously levitated and rotated. In the prior motor, simultaneous levitation and rotation are achieved by means of two kinds of stator windings: (1) main motor windings and (2) windings that exert levitating forces on a multipole rotor. The multipole geometry is suboptimum for levitation in that it presents a discontinuous surface to the stator pole faces, thereby degrading the vibration-suppression capability of the magnetic bearing.

The Morrison rotor simplifies the stator design in that the stator contains only one type of winding. The rotor is a hybrid that includes both (1) a circular lamination stack for levitation and (2) a multipole lamination stack for rotation. A prototype includes six rotor poles and eight stator poles (see figure). During normal operation, two of the four pairs of opposing stator poles (each pair at right angles to the other pair) levitate the rotor. The remaining two pairs of stator poles exert torque on the six-pole rotor lamination stack to produce rotation.

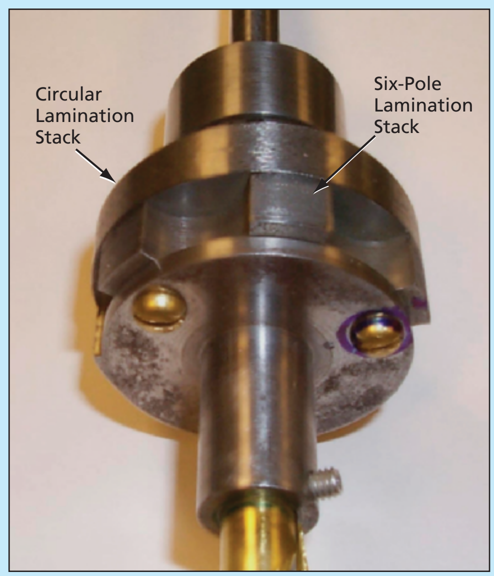
The relative lengths of the circular and multipole lamination stacks on the rotor can be chosen to tailor the performance of the motor for a specific application. For a given overall length, increasing the length of the multipole stack relative to the circular stack results in an increase in torque relative to levitation load capacity and stiffness, and vice versa.

This work was done by Carlos R. Morrison of **Glenn Research Center**. *Further information is contained in a TSP* *(see page 1)*.

Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Commercial Technology Office, Attn: Steve Fedor, Mail Stop 4-8, 21000 Brookpark Road, Cleveland Ohio 44135. Refer to LEW-17316



ASSEMBLED MOTOR



ENLARGED VIEW OF ROTOR

In This Switched-Reluctance Bearingless Motor, the rotor was simultaneously levitated and rotated at a speed of 6,000 rpm.