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NASA TECH BRIEF

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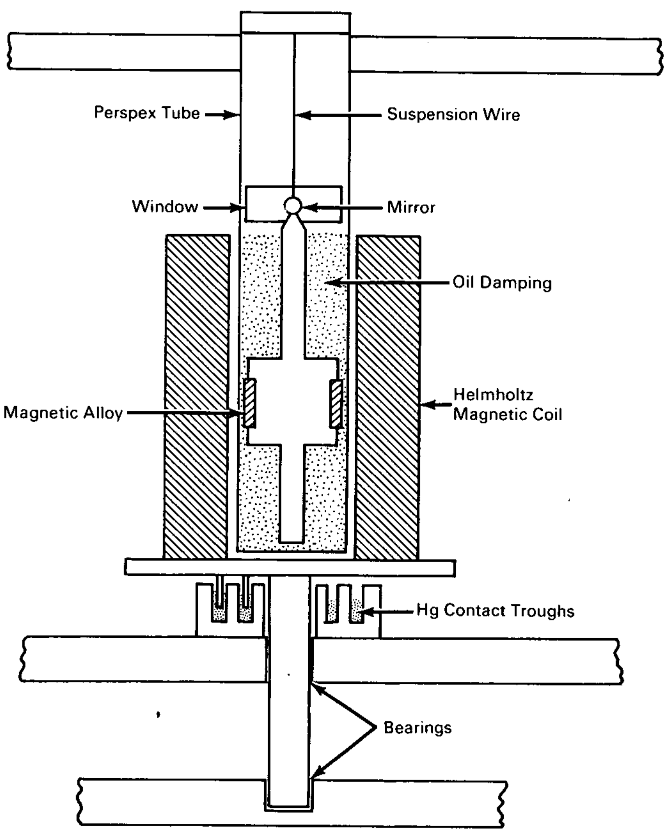
Torque Meter Aids Study of Hysteresis Motor Rings



The problem:

To develop an accurate and economical method of determining the performance of hysteresis motor rotor rings under simulated dynamic conditions. The only present means of assessing rotor ring performance, aside from the very expensive method of actually making and testing a complete motor, is to determine the conventional hysteresis loops derived from an ac or dc applied field. However, the relationship between hysteresis loops and ring performance in a motor is unclear and accurate assessments are unobtainable by this method.

The solution:

A rotational hysteresis torque meter, which, by simulating motor operation in a simplified way, allows

(continued overleaf)

rotor ring performance characteristics to be analyzed, without the need to build and test a high speed hysteresis motor. The torque meter determines hysteresis motor torque, the actual stresses of the ring due to its mechanical situation and rotation; aids in the study of asymmetries or defects in motor rings; and measures rotational hysteresis. In the slowly rotating magnetic field made possible with this instrument, the dependence of torque on the position of the field relative to the ring can be examined and the effect of discontinuities or directional properties can be measured.

How it's done:

The hysteresis torque meter is based on the principle that the torque exerted on the rotor ring of a hysteresis motor is very small at the synchronous speed, but rapidly increases to a near constant value on departure from synchronous speed. In operation, the motor may be spinning at up to 25,000 rpm, but the applied field may be rotating relative to the ring at only a few rpm out of synchronism. Therefore, the meter simulates motor operation by slowly rotating a magnetic field around a ring held stationary by an elastic suspension.

In the meter shown, a rotor ring is held in a brass clamp. The clamp, hung from a fixed post on a tungsten wire, has a mirror cemented on the top. The whole suspension is inside a Perspex tube, immersed in a damping oil. A pair of Helmholtz magnetic coils, 11.5 cm in diameter, is capable of generating a field of 76 oersteds. Contact to the coils is made through mercury troughs and the coil platform is rotated by a belt-drive from a 5 rpm motor. Antivibration mounts are used and the light beam is 200 cm long, giving a deflection of 200 mm for 124 dyne-cm of torque.

The rotor ring is held horizontally at the center of the Helmholtz coils rotating at 1 to 10 rpm. The torque exerted on the specimen is measured by the angular deflection of the mirror on the suspension wire. When the torque measurements at various speeds are extrapolated to zero speed, the synchronous torque of the motor can be measured and an assessment of the ring properties can be made.

Notes:

1. This information may be of interest to those concerned with the design, manufacture, and quality control testing of hysteresis synchronous motors.
2. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Marshall Space Flight Center
   Huntsville, Alabama 35812
   Reference: B67-10412

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

Source: M. Cole
of Metals Research Ltd.
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