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WEAR TESTING OF AEROSPACE SELF-LUBRICATING BEARING LINER MATERIALS

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INTRODUCTION

The paper describes a novel method for testing the wear rates of liner materials for self-lubricating bearings. The apparatus differs from similar machines in that it is designed for reciprocating contact, to simulate motions encountered in helicopter main rotor pitch link bearings, and is designed to test up to 4 samples at the same time, reducing the effect of variability in environmental conditions. This paper describes key aspects of the test rig along with initial results.

Self-lubricating bearings have been in widespread use since the mid-1950s, predominantly in the aerospace industry where they have the advantage of being low maintenance components. They usually consist of a spherical bearing with the inner and outer elements separated by a composite glass fibre / PTFE resin-bonded textile liner. Previous work [1] found that the wear of typical composite liners has three distinct phases – initial wear in, steady-state wear phase, final wear-out, and that humidity and environmental temperature can have a strong influence [2,3]. Typical bearing-scale tests are long duration, and so a method of accounting for environmental factors and allowing the rapid screening of materials and test conditions is described here as an aid to technology development.

WEAR TESTING RIG & INITIAL RESULTS

The rig tests four separate samples of bearing liner material held stationary and loaded against oscillating counterfaces mounted on a common drive shaft oscillating ±10° at 5 Hz in order to mimic bearing kinematics to SAE 81819 standard. Figure 1 is a section through the rig, showing one of the four loading arms. Simultaneous testing of four samples allows tests on the effects of operating parameters to be conducted under the same environmental conditions. In addition, four simultaneous tests allows a rapid programme of testing to be carried out. The vertical displacement of each arm is monitored, to indicate wear, together with temperatures. Furthermore, Acoustic Emission (AE) sensors are fitted to each sample holder, to allow monitoring of the wear

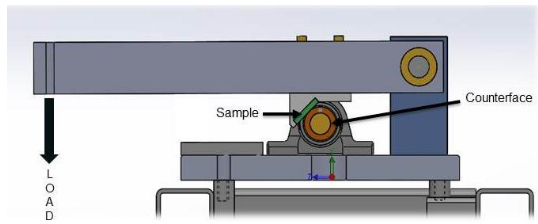

Figure 1: Test Rig arrangement

processes within each sample. AE signals measured over one oscillation (from -10° to +10°) are shown in Figure 2, for the initial and steady state wear phases.

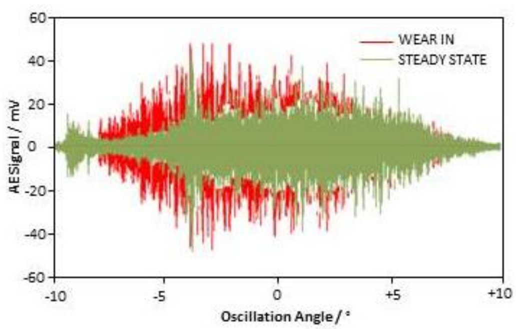

Figure 2: AE signals during initial and steady state wear

CONCLUSIONS

A suitable method for accelerating the wear testing of composite bearing liner materials for aerospace applications has been developed. The method reduces the influence of environmental conditions, and initial results show promise as a method for rapid comparative testing for technology development.

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