EXPERIMENTS WITH METAL MESH AS A BEARING DAMPER MATERIAL

Dr. Vance and his graduate students at Texas A&M developed and tested wire mesh bearing dampers to replace squeeze film dampers (SFD) in turbomachinery. The SFD is the most common type of bearing damper in use today. It has an unfavorable non-linear response and the oil's viscosity is temperature dependent. By replacing the oil film land in the SFD with a short hollow cylinder (donut) made of woven metal strands it is possible to generate damping by the energy dissipation (due to hysteresis) of the material. The first experiments used a metal mesh damper (with no squirrel cage) to support the ball bearing of a power turbine rotor and showed high damping that was independent of temperature or the presence of oil. Rotordynamic experiments were performed later with a copper metal mesh damper in parallel with a squirrel cage. These results showed that the squirrel cage allows the stiffness to be readily controlled by the designer with no loss of damping from the metal mesh. Additional experiments were conducted to better understand the mechanism of the damping and to develop design tools for rotordynamic analysis with these dampers. Spreadsheet software was developed for metal mesh damper design, using the experimental data from the test rig. The photo below in Figure 1 shows two of the metal mesh donuts, uncut (O) and cut (B) for assembly. The graph in Figure 2 shows how a copper mesh damper reduced the critical speed amplitude in a rotordynamic test rig.

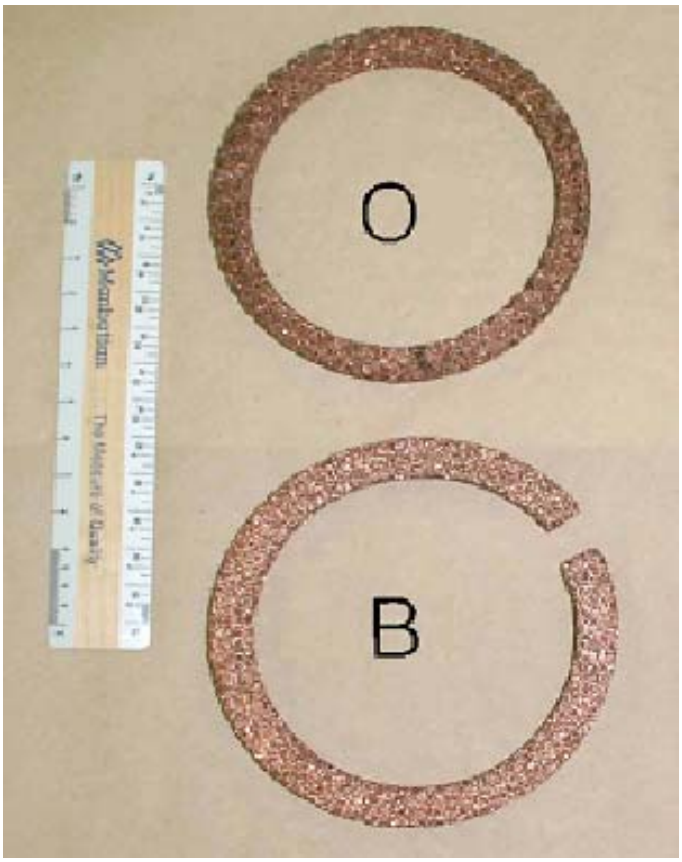

Figure 1: Copper mesh donuts

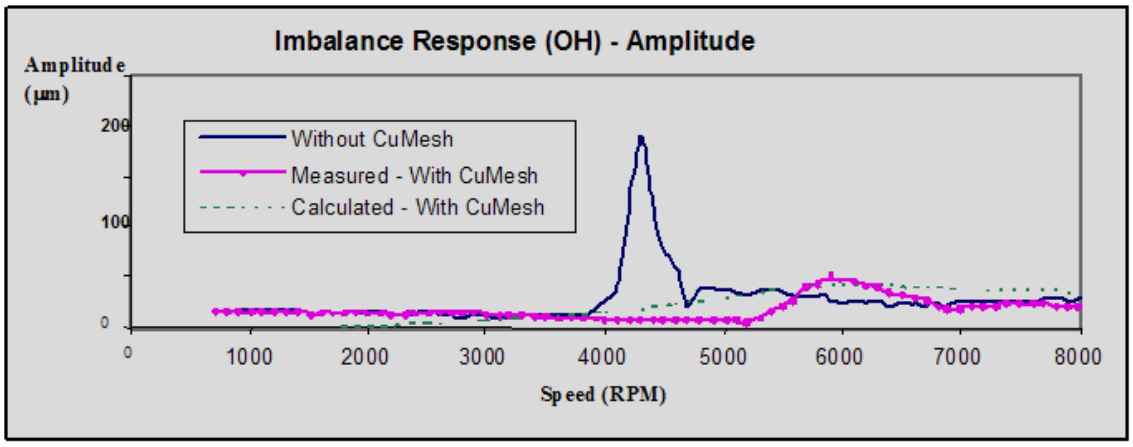

Figure 2: Imbalance response with and without a copper mesh damper in parallel with a squirrel cage support

References

1. Zarzour, M. and Vance, J., 2000, "Experimental Evaluation of a Metal Mesh Bearing Damper", Transactions of the ASME, *Journal of Engineering for Gas Turbines and Po*wer, April 2000, vol 122, pp. 326-329.

2. Al-Khateeb, E.M., and Vance, J.M., 2001, “Experimental Evaluation of a Metal Mesh Bearing Damper in Parallel with a Structural Support,” ASME Paper 2001-GT- 0247, presented at the ASME Turbo Expo, 4-7, June, 2001, New Orleans, Louisiana.

3. Ertas, B., Al-Khateeb, E.M., and Vance, J.M., 2002, “Cryogenic Temperature Effects on Metal Mesh Dampers and Liquid Hydrogen Turbopump Rotordynamics,” AIAA Paper AIAA-2002-4164, presented at the 38th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, July, 2002, Indianapolis, Indiana.