TEXAS A&M ENGINEERING
EXPERIMENT STATION

Turbomachinery Laboratory
Turbomachinery Research Consortium

Continuation Project Year V

THERMAL EFFECTS ON PAD MECHANICAL DEFORMATIONS AND TPJB PERFORMANCE

Accurate prediction of the static and dynamic forced performance of tilting pad journal bearings (TPJBs) aids to the design, troubleshoot, and verification of the dynamic response and stability of rotor-bearing systems. In the last decade, the TRC has supported Prof. Childs and numerous students to perform measurements of the dynamic force coefficients of TPJBs for compressor applications. In general, predicted force coefficients correlate well with the experiment coefficients for operation with small to large unit loads (~250 psi [17 bar]). The experiments also demonstrate the bearing stiffnesses are frequency dependent, best represented with a **K-M** model; and damping coefficients **C** are adequately represented as of viscous type.

The computational analysis will continue to enhance the predictive XLTRC² tool **XLTPJB®** by adding pad surface deformations due to thermally induced stresses. The specific tasks are:

a) Construct a FE structural model that relates pad elastic deformations ($\mathbf{U_T}$) to thermally induced stresses, $\mathbf{K_T}$ $\mathbf{U_T}$**~B**(T), as in Ref.[8]. The process is more computationally intensive than that for mechanical deformations since the temperature field (T) does not only depend on the fraction of the mechanical energy from the shearing of the film conducted through the pad but also on the (unknown and often assumed) thermal boundary conditions on the sides and back surfaces of a pad.
b) Continue benchmarking predictions of the enhanced **XLTPJB®** program with comparisons to test data.

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