TEXAS A&M ENGINEERING EXPERIMENT STATION

Turbomachinery Laboratory
Turbomachinery Research Consortium

New Project 2015

ON THE MORTON EFFECT: SIMPLIFIED PREDICTIVE MODEL FOR A THERMALLY INSTABILITY INDUCED BY DIFFERENTIAL HEATING IN A JOURNAL BEARING

A thermal instability refers to the phenomenon of rotor instability induced by an asymmetric temperature field at specific location(s) around a spinning rotor in a turbomachinery, a machine where either power is extracted or delivered to a fluid. The coupling of the asymmetrical thermal field and the synchronous rotor whirl usually results in an excessive rotor amplitude of motion, hence preventing machines to operate, even speed up to, the designed speed and load. When operating at a constant shaft speed, the typical symptom of such phenomenon is spiral rotor motions, with a growing amplitude and increasing phase as observed in a polar plot.

A ready to use engineering method is needed for both the evaluation (prognosis) and practical solution (diagnostic or troubleshooting) of the Morton effect for engineering applications. To this end, a two year project will seek practical yet reliable predictions of Morton effect.

At the end of Year I, the work will deliver

- A ready-implemented approach for the evaluation of thermal instability induced by differential heating around the journal in a fluid film bearing.
- List practical methods for the solution of the Morton effect, along with an evaluation of their impact (implementation) on system rotordynamics.
- Provide an improved theory of coupled dynamics of multi-physical fields in turbomachinery.
- Design of the test rig for experimental verification in year II
- Improved experimental technique for temperature field of a rotating shaft in a closed small space.

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