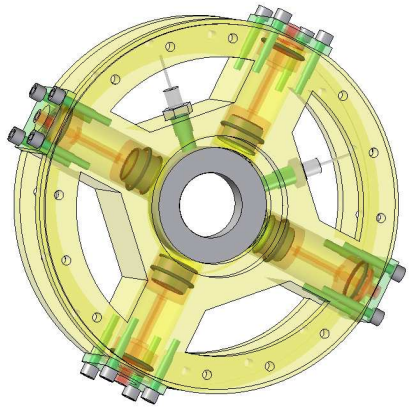
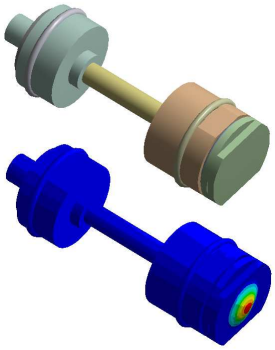
The Centre for Power Transmission and Motion Control

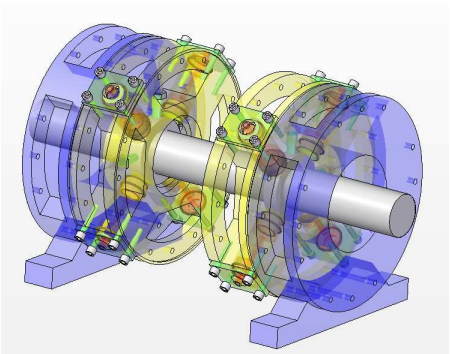
UNIVERSITY OF BATH

Research Project

CONTROLLED ESCAPE FROM TRAPPED MODES IN ROTOR/MAGNETIC BEARING SYSTEMS







Motivation

Rotating machinery equipped with magnetic bearings requires auxiliary/back-up bearings to prevent contact between the rotor and stator laminations. The lifetime of these auxiliary bearings is currently given in terms of a small number of rotor/bearing contacts. As a result of a system disturbance, different types of contact scenario may occur. These include: Single or multiple rotor/bearing contacts after which the rotor returns to a stable orbit within the rotor/bearing clearance; Continuous rotor/bearing rub; The rotor may get trapped in a periodic and/or non-periodic rotor/bearing contact mode. It is therefore important, particularly in the latter case, to be able to minimise contact forces and return the rotor to a stable orbit within the bearing clearance.

Active auxiliary bearings

A system involving an actively controlled auxiliary bearing is proposed to allow dynamic variation of the effective bearing stiffness, damping and clearance. This will enable reduction of mechanical and thermal stresses due to rotor/bearing contact. Furthermore, it is envisaged that variation of the control forces applied to the rotor by the auxiliary bearing can used to return the rotor to a stable orbit, within the clearance gap.

Project outline

Current work is focused on finalising the design and modelling of the active magnetic bearing system with actively controlled auxiliary bearings. Formulation of the control problem using an LMI approach has been proposed to control the position of the rotor (using the active magnetic bearings) and auxiliary bearings separately. Finally, a combined control strategy to achieve reduced rotor/bearing contact forces and escape from trapped contact modes is to be investigated.

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