# Dynamics and stability of rigid rotors levitated by passive cylinder-magnet bearings and driven/supported axially by pointwise contact clutch - DTU Orbit (09/11/2017)

**Dynamics and stability of rigid rotors levitated by passive cylinder-magnet bearings and driven/supported axially by pointwise contact clutch**

A stable rotor—supported laterally by passive magnetic bearings and longitudinally by magnetic forces and a clutch—loses suddenly its contact to the clutch and executes abruptly longitudinal movements away from its original equilibrium position as a result of small increases in angular velocity. Such an abrupt unstable behaviour and its reasons are thoroughly theoretically as well as experimentally investigated in this work. In this context, this paper gives theoretical as well as experimental contributions to the problem of two dimensional passive magnetic levitation and one dimensional pointwise contact stability dictated by mechanical–magnetic interaction. Load capacity and stiffness of passive multicylinder magnetic bearings (MCMB) are thoroughly investigated using two theoretical approaches followed by experimental validation. The contact dynamics between the clutch and the rotor supported by MCMB using several configurations of magnet distribution are described based on an accurate nonlinear model able to reliably reproduce the rotor-bearing dynamic behaviour. Such investigations lead to: (a) clear physical explanation about the reasons for the rotor's unstable behaviour, losing its contact to the clutch and (b) an accurate prediction of the threshold of stability based on the nonlinear rotor-bearing model, i.e. maximum angular velocity before the rotor misses its contact to the clutch as a function of rotor, bearing and clutch design parameters.

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