Université catholique de Louvain UCL SECTEUR DES SCIENCES ET TECHNOLOGIES

INSTITUTE OF MECHANICS, MATERIALS AND CIVIL ENGINEERING

Invitation à la soutenance publique de thèse

Pour l'obtention du grade de Docteur en Sciences de l'Ingénieur

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Master ingénieur civil électromécanicien

Heteropolar null-flux electrodynamic bearings for the passive radial suspension of rotors

Magnetic bearings allow to support a rotating object without contact. This makes them more suitable than mechanical bearings for applications where removing the wear or the lubrication is highly sought-after, for example. Nowadays, the magnetic bearings used in the industry are actively controlled. However, the complexity, the cost, and the overall dimensions associated with this control system can be prohibitive in some applications. These disadvantages could be overcome by using magnetic bearings that do not require external control means, such as electrodynamics bearings (EDBs). However, the latter have not made their way out of the labs yet due to their low stiffness and stability issues.

In this context, this thesis aims at taking one further step toward the implementation of heteropolar EDBs in practical applications. To this end, this work first proposes a quasi-static model of EDBs. The analysis of this model yields new design guidelines upon which original bearing topologies are brought to light. Then, a dynamic model is introduced. As opposed to quasi-static models, it allows for predicting the bearing dynamics rigorously as it includes no assumption on the rotor kinematics. Additionnaly, this model is linear. Therefore, the bearing stability can be easily predicted using conventional system analysis tools.

Thanks to this model, the impact of the winding yoke permeability on the stability and stiffness of slotless EDBs is first evaluated. Secondly, an upper bound for the performance of a yokeless EDB is obtained. Lastly, it is shown that the radial forces due to rotor eccentricities in permanent magnet motors can also be successfully predicted with the dynamic model.

Mercredi 15 mars 2017 à 16h15

Auditoire SUD 19
Croix du Sud
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