

Mechanical Characterization of Journal Superconducting Magnetic Bearings: Stiffness, Hysteresis and Force Relaxation

Cristian Cristache², Ignacio Valiente-Blanco², Efren Diez-Jimenez¹,
Marco Antonio Alvarez-Valenzuela¹, Nelson Pato³ and Jose Luis Perez-Diaz¹

E-mail: ediez@ing.uc3m.es

¹*Departamento de Ingeniería Mecánica. Universidad Carlos III de Madrid. Spain.*

²*Instituto Pedro Juan de Lastanosa. Universidad Carlos III de Madrid. Spain.*

³*Faculdade das Ciências da Universidade de Lisboa. Portugal*

Abstract - Superconducting magnetic bearings (SMBs) can provide stable levitation without direct contact between them and a magnetic source (typically a permanent magnet). In this context, superconducting magnetic levitation provides a new tool for mechanical engineers to design non-contact mechanisms solving the tribological problems associated with contact at very low temperatures. In the last years, different mechanisms have been proposed taking advantage of superconducting magnetic levitation: flywheels, conveyors or mechanisms for high-precision positioning. In this work the mechanical stiffness of a journal SMBs have been experimentally studied. Both radial and axial stiffness have been considered. The influence of the size and shape of the permanent magnets (PM), the size and shape of the HTS, the polarization and poles configuration of PMs of the journal SMB have been studied experimentally. Additionally, in this work hysteresis behavior and force relaxation are considered because they are essential for mechanical engineer when designing bearings that hold levitating axles.

Keywords - Superconducting magnetic bearing, mechanical stiffness, magnetic levitation, HTS bulk material