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Electromechanical prediction of the regime of lubrication in ball bearings using Discrete Element Method

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Abstract

The present paper deals with an original 2D modeling of mechanical state of ball bearings in dynamic mode using the Discrete Element Method (DEM). An electromechanical coupling is introduced to extract an electrical and measurable response of a bearing in operation, for monitoring and diagnostic purposes. Recent research activities at the LTI have helped us to measure, to understand and to simulate the electrical response of multi-contact systems. In this work, we have been interested in both multi-scale and multi-physics modeling of ball bearings in dynamics where mechanical and electrical effects, induced by the isothermal lubricated contact are studied. From DEM coupled simulations, the main goal is to predict the lubricant regime according to operating conditions in order to improve the bearing lifetime. The lubrication regime responsible for electromechanical coupling can be identified according to Stribeck curve with the assumption of a piezo-viscous-elastic behaviour of the lubricant.

Keywords: Discrete Element Method, Lubricated contact, Electromechanical coupling, Bearing, Monitoring

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