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Numerical simulation and experimental comparison of flaw evolution on a bearing raceway: case of thrust ball bearing

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Abstract

Bearings are essential elements in the design of rotating machines. In an industrial context, bearing failure can have costly consequences. This paper presents a study of the rolling contact fatigue damage applied to thrust ball bearings. It consists in building a dynamic three-dimensional numerical model of the cyclic shift of a ball on an indented rolling surface, using finite element analysis (FEA). Assessment of the evolution in size of a surface spall as a function of loading cycles is also performed using FEM coupled with fatigue laws. Results are in good agreement with laboratory tests carried out under the same conditions using a fatigue test cell dedicated to ball bearings. This study may improve knowledge about estimating the lifetime of rolling components after onset of a spall using FEA and accounting for structural damage state.

Keywords: Rolling contact fatigue damage, thrust ball bearing, FEA, lifetime, raceway indent

1. Introduction

In the framework of predictive maintenance, several topics have been investigated to improve understanding of the mechanisms of bearing fatigue damage. One of them consists in monitoring the evolution of the size of a spall on the bearing raceway, in

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