Identifiant de la contribution : **210** Type : **non spécifié**

"DYN1#5 - Exploring the Impact of Defect Geometry on Bearing Dynamic Behavior Using Spall and Indentation Models"

mardi 11 juillet 2023 15:20 (20)

Dynamic modeling of a bearing is an effective tool that is used to research the bearing behavior under various conditions. Models yield clean results that include data that cannot be obtained through direct experimentation, such as internal forces and the positions of rolling elements. By simulating a faulty bearing, it is possible to thoroughly examine the effect of the defect's shape on the bearing's dynamic behavior. The model enables the exploration of correlations between the severity of the defect and observable outcomes (such as outer ring vibrations). These insights are essential for developing diagnostic techniques to assess the bearing's condition during operation. This study introduces two types of defect geometries incorporated into a previously validated deep-groove dynamic model. The first is an improved spall model that represents the entrance and exit of the spall as linear-like slopes, and the second is a model of indentation defect. A comparison of the defect geometries indicated that both indentation and spall exhibit a similar pattern of dynamic behavior. The study's results demonstrate that under specific conditions, the slope of the spall's exit may affect the duration of the ball-defect interaction and the maximum acceleration of the outer ring. However, when only the intermediate range of exit slopes was examined the effect on the bearing dynamics was negligible. This could be explained by the relatively large size of the ball compared to the defect depth that causes it to strike the same location at the spall's exit. Conversely, the slope of the spall's entrance has no influence. This can be attributed to the free fall of the ball into the spall, which prevents the interaction of the ball with the entrance.

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Classification par session : Survishno 4 / Dynamic modelling 1