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On The Dynamic and Thermal Performance of a Zero Clearance Auxiliary Bearing(zcab) for a Magnetic Bearing System©

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Structural and thermal analysis of a zero clearance auxiliary bearing (ZCAB) for magnetic bearing systems is presented. The ZCAB consists a series of rollers whose centers are initially placed on a circle. At the open condition all rollers have an initial clearance about the rotating shaft. As the shaft drops on the ZCAB rollers, either due to failure of the magnetic bearing system or a transient shock, the centers of the rollers move circumferentially along a curve path and after eliminate the initial clearance by closing around the shaft and re-centering it. This is known as the closed condition. The overall stiffness of the ZCAB will then depend on the stiffness of each single roller and the initial clearance between the rollers and the shaft. This is affected by the number of rollers that will touch the shaft which will also vary the load applied on the rollers. The low shaft-rollers traction coefficient and overall dynamic support characteristics obviate the possibility of backward whirl, however this traction and the generated heat in the rolling element embedded in the rollers are sources of heat generation. This paper presents the results of a transient analysis for the ZCAB structural stiffness. A preliminary thermal model of the ZCAB and comparison between the predictions and test results are also discussed. Some design guidelines are presented to help improve the performance of the ZCAB in the case of high temperature working conditions.