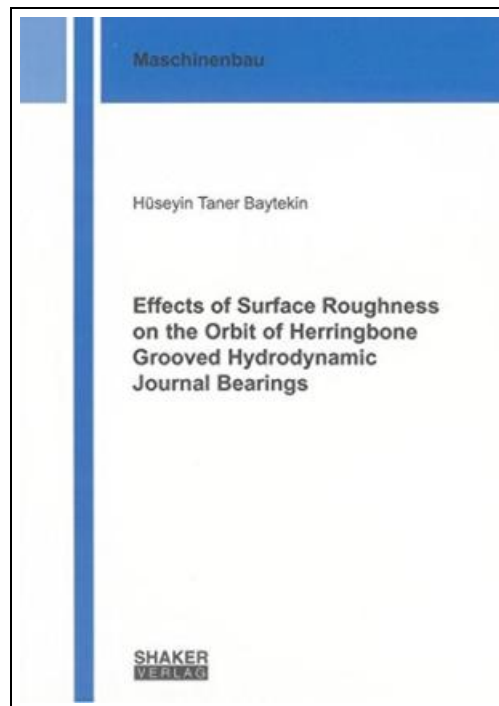


## Effects of Surface Roughness on the Orbit of Herringbone Grooved Hydrodynamic Journal Bearings



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## EFFECTS OF SURFACE ROUGHNESS ON THE ORBIT OF HERRINGBONE GROOVED HYDRODYNAMIC JOURNAL BEARINGS



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Shaker Verlag Jun 2011, 2011. Taschenbuch. Condition: Neu. Neuware - Herringbone grooved hydrodynamic bearings are employed in applications that require high precision rotation. One of the most important applications is a hard disk drive (HDD) spindle motor. Over the past decade ball bearings were replaced by hydrodynamic fluid film bearings in order to have fast, quiet, and reliable operation of the spindle motor in a HDD. Reliable operation of such precision equipment depends heavily on the bearing properties. Bearing clearance in a hydrodynamic bearing system of a spindle motor is in the order of micrometers. Having such tight bearing clearances, production tolerances have great influence on the dynamic properties like stiffness and damping. Effects of surface roughness on the dynamic properties of the hydrodynamic journal bearing are not known in detail. In the course of this study investigations by means of numerical simulation have been carried out to find out the effect of surface roughness on the orbit of a herringbone grooved hydrodynamic journal bearing. The Reynolds equation is the governing partial differential equation for the pressure distribution in hydrodynamic bearings. It is derived from the Navier-Stokes equations under certain assumptions. Finite element method (FEM) has been employed to solve the Reynolds equation for complex bearing geometries. Analytical solutions available for simple geometries have been utilized to verify the FEM code. Additionally, validation has been carried out by comparison with available experimental studies. A surface roughness generation method is developed which is appropriate for cylindrical surfaces. Surface roughness has been modeled using appropriate random number generators and fast Fourier transformation. An integration method with constant time step size is used to eliminate interpolation of the surface roughness, which may cause undesired disturbances, during the generation of the time dependent grid. The equation of motion is integrated by coupling the Reynolds...

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