1. Study on the influence of internal bearing parameters on the critical speed and vibration behavior of the rotor-bearing coupled system

Zhang, Fanyu (1, 2); Zhao, Yulai (1, 2); Zhu, Qingyu (2, 3); Meng, Xiangyu (1, 2); Lin, Junzhe (1, 2); Han, Qingkai (1, 2)
Source: *Applied Mathematics and Mechanics (English Edition)*, v 47, n 3, p 653-674, March 2026; **ISSN:** 02534827, **E-ISSN:** 15732754; **DOI:** 10.1007/s10483-026-3357-7; **Publisher:** Springer Science and Business Media B.V.
Author affiliation: (1) School of Mechanical Engineering and Automation, Northeastern University, Shenyang; 110819, China (2) Laboratory of Vibration and Control of Aero-Propulsion System Ministry of Education of China, School of Mechanical Engineering and Automation, Northeastern University, Shenyang; 110819, China (3) Department of Mechanical Engineering, Tsinghua University, Beijing; 100084, China
Abstract: The dual challenges of critical speed prediction inaccuracies and ambiguous vibration behaviors are present in high-speed flexible rotors, particularly in free turbine rotors in turboshaft engine systems. The study begins with an examination of the rotor-bearing bidirectional coupling mechanism, with a primary focus on the nonlinear characteristics of the bearing. An investigation is carried out on the mechanical modeling methodologies for four-point contact ball bearings (FPCBBs) and cylindrical roller bearings (CRBs). To address the issue of excessive computational time in traditional bearing calculation methods, the sled dog optimization (SDO) algorithm is substituted for the conventional Newton-Raphson method. A rotor-bearing coupling dynamics model is developed by the finite element and lumped mass methods, with experimental validation achieved through a simulator test rig. The effects of three internal bearing parameters in FPCBBs (arching width and raceway groove curvature coefficient) and CRBs (initial radial clearance) on the critical speed characteristics and vibrational behavior of rotor-bearing coupled systems are examined. The numerical simulation results show some interesting conclusions. © Shanghai University 2026. (50 refs)
Main heading: Point contacts
Controlled terms: Ball bearings - Bearing pads - Cylindrical roller bearings - Newton-Raphson method - Turbine components
Uncontrolled terms: Coupled systems - Critical speed - Cylindrical roller-bearing - Four-point - Optimization algorithms - Rotor-bearing - Rotor-bearing coupled system - Sled dog optimization algorithm - Th133 - Vibration behaviours
Classification Code: 601.2 Machine Components - 704.1 Electric Components - 714.2 Semiconductor Devices and Integrated Circuits - 1007.1 Turbines and Steam Turbines - 1201.9 Numerical Methods
Database: Compendex
Data Provider: Engineering Village

2. Dynamic behaviors of a rolling bearing-rotor system with bearing extended defect and shaft crack: simulation and experimental investigation

Luo, Yuegang (1); Liu, Ning (1); Xiao, Songsong (1); Wang, Wanlei (1)
Source: *Mechanical Systems and Signal Processing*, v 247, March 1, 2026; **ISSN:** 08883270, **E-ISSN:** 10961216; **DOI:** 10.1016/j.ymssp.2026.113978; **Article number:** 113978; **Publisher:** Academic Press
Author affiliation: (1) School of Mechanical and Electronic Engineering, Dalian Minzu University, Liaoning, Dalian; 116600, China
Abstract: Rolling bearings are assembled on the shaft through interference fit. The presence of shaft cracks directly affects bearing operation and may even induce defects. Conversely, bearing defects may also exacerbate shaft damage. Currently, research on the bearing defect-shaft crack coupled faults remains insufficient and requires further exploration. This paper proposes an inner raceway extension defect model that incorporates the motion trajectory of the rolling elements. A dynamic model of a rotor-bearing-pedestal system with bearing extension defect and shaft crack is established. The dynamic characteristics of defects, cracks, and coupled faults are systematically analyzed, and the coupling mechanism is further investigated. The simulation and experimental results indicate that for inner raceway defect-shaft crack coupled fault, an increase in crack depth amplifies the bearing fault characteristics, especially when the crack is located near the bearing support or at the midspan of the shaft. The extension of the defect also exacerbates the damage caused by the crack to the shaft. For outer raceway defect-crack coupled fault, shallow cracks suppress the bearing fault frequency. However, once the crack depth exceeds a certain threshold, this suppression transitions to amplification. Cracks located at the midspan of the shaft enhance the bearing fault characteristics. The extension of the outer raceway defect primarily affects the bearing fault frequency and the overall vibration amplitude. The findings of this study are expected to provide a valuable theoretical basis for diagnosing and predicting bearing defect-shaft crack coupled faults. © 2026 Elsevier Ltd (76 refs)
Main heading: Crack propagation
Controlled terms: Bearing pads - Roller bearings
Uncontrolled terms: Bearing defect - Bearing fault - Coupled fault - Crack depths - Defect (crack) - Extension defect - Non-linear vibrations - Rolling bearings - Rotor-bearing-pedestal systems - Shaft crack
Classification Code: 214.1.2 Fatigue, Cracks and Fracture - 601.2 Machine Components
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Database: Compendex
Data Provider: Engineering Village

3. Performance analysis and quantitative assessment of a wind turbine novel main sliding bearing within misalignment and nonlinear deformation effects

Zhang, Ronghua (1); Song, Chaosheng (1); Tan, Jianjun (1); Zhou, Ye (1); Zhang, Jiajia (2)
Source: *Mechanical Systems and Signal Processing*, v 244, January 15, 2026; **ISSN:** 08883270, **E-ISSN:** 10961216; **DOI:** 10.1016/j.ymssp.2025.113787; **Article number:** 113787; **Publisher:** Academic Press
Author affiliation: (1) State Key Laboratory of Mechanical Transmission for Advanced Equipment, Chongqing; 400044, China (2) Research Institute CSSC Haizhuang Windpower Co., Ltd., Chongqing; 401122, China
Abstract: The replacement of rolling bearings with sliding bearings in wind turbine main shafts represents a significant and promising advancement in transmission technology. However, the dynamic characteristics of non-uniformly distributed journal–thrust coupled tilting-pad bearings remain insufficiently understood under the complex, low-speed, and heavy-load operating conditions of main shafts, which restricts their broader application. This study develops a novel tribo-dynamics model that incorporates transient hydrodynamic pressure and the nonlinear deformation of composite pad–flexible pivot structures, thereby capturing the fluid–structure interaction and bidirectional dynamic misalignment of the bearing under dynamic loads. A quantitative assessment was conducted for a 6 MW wind turbine main-shaft new sliding bearing. The results demonstrate that nonlinear coordination between composite pads and flexible pivots enhances load-carrying stability under dynamic conditions by maintaining oil film thickness, though it results in increased axial displacement. Under heavy loads, large structural deformations exacerbate misalignment (especially vertically), which is a direct cause of the increased coupled bearing axial displacement. Furthermore, the asymmetric tilting-pad radial configuration reveals a unique multi-pad coupling mechanism, whereby axial oscillation of pad 5 alleviates jamming during y-axis misalignment reversal. The proposed model and findings provide new theoretical insights into the dynamic coupling and lubrication mechanisms of advanced sliding bearings, offering practical guidance for optimizing the design and improving the operational reliability of wind turbine main shaft systems. © 2025 Elsevier Ltd (67 refs)
Main heading: Wind turbines
Controlled terms: Alignment - Bearing pads - Dynamic loads - Dynamics - Roller bearings - Thrust bearings - Turbine components
Uncontrolled terms: Axial displacements - Coupling mechanism - Heavy loads - Main-shaft - Misalignment - Nonlinear deformations - Performances analysis - Quantitative assessments - Sliding bearing - Tribo-dynamic
Classification Code: 408 Structural Design - 601.1 Mechanical Devices - 601.2 Machine Components - 1007.1 Turbines and Steam Turbines - 1008.5 Wind Power and Wind Power Generation - 1301.1.1 Mechanics - 1301.7 Statistical and Nonlinear Physics
Funding Details: Number: 2022YFB4201100, Acronym: NKRDPC, Sponsor: National Key Research and Development Program of China; Number: -, Acronym: NKRDPC, Sponsor: National Key Research and Development Program of China; Number: CSTB2024NSCQ-BSX0002, Acronym: -, Sponsor: -;
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Database: Compendex
Data Provider: Engineering Village

4. Mechanical Performance Analysis of Hydrostatic Thrust Bearing under Microbevel Parameters

Zhang, Yanqin (1); Tao, Jianting (1); Ni, Shiqian (2); Zhao, Rong (1)
Source: *Recent Patents on Engineering*, v 19, n 4, 2025; **ISSN:** 18722121, **E-ISSN:** 22124047; **DOI:** 10.2174/1872212118666230224121459; **Publisher:** Bentham Science Publishers
Author affiliation: (1) Mechanical Engineering Department, Nanjing Institute of Technology, Nanjing; 211167, China (2) Railway Transportation Acadimy, Nanjing Vocational Institute of Transport Technology, Nanjing; 211188, China
Abstract: Background: Heavy-duty hydrostatic bearings of the original parallel friction pair are prone to hydrostatic loss problems during operation. Aims: The aim is to solve the problem of lubrication failure, the original hydrostatic oil pad was designed as a micro-inclined plane, and the dynamic pressure caused by the micro-wedge of the oil pad at a higher speed was used to compensate for the static pressure loss of the bearing. Objective: This study aims at a new type of q1-205 micro bevel double rectangular cavity hydrostatic bearing. Methods: The mathematical model of oil film theoretical analysis of hydrostatic bearing with the micro-inclined surface was established, including the flow equation of a double rectangular cavity with a micro-inclined surface and static and dynamic bearing capacity equation. Results: In this patent paper, the mechanical properties of oil film with tilt height between 0 and 0.1mm were simulated with variable viscosity, and the distribution law of pressure field under different working conditions was obtained. Through the experimental study, the

pressure data of parallel flat pads and tilting pads under different working conditions are measured and compared with the simulation data. Conclusion: The pressure loss value of the Δh ≈ 70 μm oil pad designed in this paper is relatively small under extreme working conditions. The overall loss rate is about 10% ~ 20%, and the dynamic pressure compensation rate is about 16%. The dynamic pressure generated by the slight inclination Angle can well compensate for the static pressure loss. © 2025 Bentham Science Publishers. (22 refs)
Main heading: Hydrostatic bearings
Controlled terms: Friction - Hydrostatic pressure - Thrust bearings
Uncontrolled terms: Dynamic pressure performance - Dynamic pressures - Hydrostatic thrust bearings - Micro-bevel double rectangular cavity - Performance - Pressure loss - Rectangular cavity - Static pressure - Variable viscosity - Wedge height
Classification Code: 301.2 Hydrodynamics - 601.2 Machine Components - 1301.1.1 Mechanics
Funding Details:
Funding text: This work was supported by \u201CThe Qinglan Project\u201D of Jiangsu Universities in 2022.
Database: Compendex
Data Provider: Engineering Village

5. Transient characteristics investigation on axis orbit of flexible pivot tilting pad hybrid bearing

Wang, Lili (1); Zou, Rui (1); Chen, Ming (1); Xu, Sen (1); Wang, Xiuli (1)
Source: *Industrial Lubrication and Tribology*, v 77, n 7, p 1240-1249, September 2025; **ISSN:** 00368792, **E-ISSN:** 17585775; **DOI:** 10.1108/ILT-12-2024-0461; **Publisher:** Emerald Publishing
Author affiliation: (1) College of Mechanical and Electronic Engineering, Shandong University of Science and Technology, Qingdao, China
Abstract: Purpose – The analysis on the convergence, stability and divergence degree of axis orbit can effectively evaluate the internal lubrication characteristics and operating state of journal bearing. This paper aims to propose a flexible pivot tilting pad hybrid bearing, the bearing combines the advantages of the hydrostatic bearing and tilting pad bearing, and analyzes the transient characteristics of the bearing rotor. Design/methodology/approach – The mathematical model of rotor system supported by the flexible pivot tilting pad hybrid journal bearing is established. The transient characteristics of nonlinear axis trajectory under different loads are studied by Euler method. At the same time, the influence of unbalance load on the axis trajectory and motion parameters of bearing is studied. Findings – The results show that when the bearing is not subjected to external load, the oil film force of bearing is all used to balance its own gravity; after reaching equilibrium state, the displacement of rotor, swing angle of each bush, nonlinear oil film force and maximum pressure cannot change. When the external load is unbalanced load, the motion parameters of bearing have been oscillating in the stable period; the larger the unbalanced load is, the larger the vibration amplitude of bearing motion parameters is. Originality/value – The research is of great significance for improving the theory of tilting pad hybrid journal bearing and axis trajectory theory. © 2025 Emerald Publishing Limited (22 refs)
Main heading: Trajectories
Controlled terms: Bearing pads - Hydrostatic bearings - Rotation - Rotors
Uncontrolled terms: Axis orbits - Flexible pivot - Flexible pivot tilting pads - Hybrid bearings - Hybrid journal bearing - Motion parameters - Tilting pad - Tilting pad hybrid bearing - Transient characteristic - Unbalanced loads
Classification Code: 601.2 Machine Components - 656 Space Flight and Research - 1301.1.1 Mechanics
Database: Compendex
Data Provider: Engineering Village

6. Rotordynamic effects of bearing misalignment and arrangement in angular contact ball bearing with full stiffness matrix (*Open Access*)

Goswami, Giota (1); Nutakor, Charles (1); Sopanen, Jussi (1)
Source: *Mechanics Based Design of Structures and Machines*, v 54, n 1, 2026; **ISSN:** 15397734, **E-ISSN:** 15397742; **DOI:** 10.1080/15397734.2026.2652530; **Article number:** 2652530; **Publisher:** Taylor and Francis Ltd.
Author affiliation: (1) Laboratory of Machine Dynamics, Department of Mechanical Engineering, Lappeenranta-Lahti University of Technology LUT, Lappeenranta, Finland
Abstract: Rotor-bearing modeling is essential for the safe operation of rotating machinery. Typically, in practice, bearings can be loosely fitted to the housing to allow axial thermal elongation of the rotor which can cause misalignment of the bearing. This phenomenon is investigated in this study using a full ball bearing stiffness matrix including cross-coupling terms with a three-dimensional solid finite element rotor model. The effect of misalignment on bearing stiffness and rotordynamics is studied. The results show a significant drop in stiffness due to drastic changes in the contact forces and their distribution between the balls and the raceway. Consequently, there are changes in the rotor's critical speeds and mode shapes as a

result of bearing arrangement and misalignment. (50 refs)
Main heading: Stiffness matrix
Controlled terms: Alignment - Angular contact ball bearings - Bearing pads - Stiffness
Uncontrolled terms: 3d solid element - 3d solids - Angular contacts - Bearing misalignments - Bearing modeling - Bearing stiffness - Misalignment - Rotors dynamics - Solid elements - Stiffness matrices
Classification Code: 214 Materials Science - 408 Structural Design - 601.1 Mechanical Devices - 601.2 Machine Components - 1201.4 Applied Mathematics
Funding Details: Number: -, Acronym: AKA, Sponsor: Research Council of Finland;
Funding text: The authors would like to acknowledge the support of the Academy of Finland\u2019s Center of Excellence in High-Speed Energy Conversion System.
Open Access type(s): All Open Access, Hybrid Gold
Database: Compendex
Data Provider: Engineering Village

7. Investigating the Effect of Vibration Signal Length on Bearing Fault Classification Using Wavelet Scattering Transform (*Open Access*)

Janjarasjitt, Suparerk (1)
Source: *Sensors*, v 25, n 3, February 2025; **E-ISSN:** 14248220; **DOI:** 10.3390/s25030699; **Article number:** 699; **Publisher:** Multidisciplinary Digital Publishing Institute (MDPI)
Author affiliation: (1) Department of Electrical and Electronic Engineering, Ubon Ratchathani University, 85 Sathonlamak, Warin Chamrap, Ubon Ratchathani, 34190, Thailand
Abstract: Bearing condition monitoring and prognosis are crucial tasks for ensuring the proper operation of rotating machinery and mechanical systems. Vibration signal analysis is one of the most effective techniques for bearing condition monitoring and prognosis. In this study, the wavelet scattering transform, derived from wavelet transforms and incorporating concepts from scattering transform and convolutional network architectures, was utilized to extract quantitative features from vibration signals. The number of wavelet scattering coefficients obtained from vibration signals of different lengths varied due to the use of predefined wavelet and scaling filters in the wavelet scattering network. Additionally, these wavelet scattering coefficients are associated with different scattering paths within the corresponding wavelet scattering networks. Eight different lengths of vibration signals, associated with fifteen classes of rolling element bearing faults and conditions, were investigated using wavelet scattering feature extraction. The classes of rolling element bearing faults and conditions included normal bearings as well as ball and inner race faults with various fault diameters ranging from 0.007 inches to 0.028 inches. For the specific dataset validated, the computational results indicated that excellent bearing fault classification was achievable using wavelet scattering feature vectors derived from vibration signals with lengths of at least 6000 samples. (47 refs)
Main heading: Wavelet transforms
Controlled terms: Ball bearings - Roller bearings
Uncontrolled terms: Bearing condition monitoring - Bearing fault - Condition - Fault classification - Scattering co-efficient - Scattering networks - Scattering transforms - Support vectors machine - Vibration signal - Wavelet scattering transform
Classification Code: 601.2 Machine Components - 1201.3 Mathematical Transformations
Open Access type(s): All Open Access, Gold, Green
Database: Compendex
Data Provider: Engineering Village

8. Theoretical and Experimental Study on a Novel Porous Tilting Pad Gas Thrust Bearing with Umbrella-Type Dampers

Han, Shaocun (1, 2); Li, Jian (1); Wang, Jianwei (1); Yang, Jinggui (1); Zhang, Pengfei (1); Feng, Kai (1, 2)
Source: *Tribology Transactions*, v 68, n 3, p 471-488, 2025; **ISSN:** 10402004, **E-ISSN:** 1547397X; **DOI:** 10.1080/10402004.2025.2482607; **Publisher:** Taylor and Francis Ltd.
Author affiliation: (1) College of Mechanical and Vehicle Engineering, Hunan University, Changsha, China (2) Greater Bay Area Institute for Innovation, Hunan University, Guangzhou, China
Abstract: To expand the application scope of gas bearings in oil-free turbomachinery, this paper presents a novel porous tilting pad gas thrust bearing (PTPGTB) with umbrella-type dampers (UDs) incorporating viscoelastic material. This damper, fabricated using additive manufacturing, can shrink like an umbrella to squeeze the viscoelastic material from all directions so as to dissipate more energy. A comprehensive theoretical model is proposed by coupling the PTPGTB model and the UD model. Dynamic load tests and load capacity tests are carried out. The experimental results generally agree with the

predicted results. The effects of nominal clearance, supply pressure, rotational speed, and UD geometry parameters are discussed. The variations of hydrostatic and hydrodynamic effects in PTPGTBs with different parameters are revealed. The results show that smaller clearances, lower rotational speeds, higher supply pressures, and greater axial stiffness increase the load capacity of PTPGTBs. The research can provide a new design idea and theoretical guidance for improving the load capacity of gas thrust bearings. © 2025 Society of Tribologists and Lubrication Engineers. (34 refs)
Main heading: Gas bearings
Controlled terms: Bearing pads - Dynamic loads - Gas lubricated bearings - Gas turbines - Hydrodynamics - Hydrostatic bearings - Thrust bearings - Tribology
Uncontrolled terms: Gas thrust bearing - Load capacity - Oil-free - Rotational speed - Supply pressure - Theoretical modeling - Tilting pad - Umbrella-type damper - Visco-elastic material - Viscoelastic material
Classification Code: 301.2 Hydrodynamics - 408 Structural Design - 601.2 Machine Components - 606 Lubrication and Tribology - 606.2 Lubrication - 608.3 Gas Turbines and Engines
Funding Details: Number: 2021YFF0603000, Acronym: NKPs, Sponsor: National Key Research and Development Program of China; Number: -, Acronym: NKPs, Sponsor: National Key Research and Development Program of China; Number: 2023JJ30140, Acronym: -, Sponsor: Natural Science Foundation of Hunan Province; Number: -, Acronym: -, Sponsor: Natural Science Foundation of Hunan Province;
Funding text: The authors acknowledge the financial support by National Key Research and Development Program of China (2021YFF0603000), Natural Science Foundation of Hunan Province (Grant No. 2023JJ30140).
Database: Compendex
Data Provider: Engineering Village

9. Tribodynamic behavior of a novel double bearing layout for the main shaft system of wind turbines

Zhang, Ronghua (1); Song, Chaosheng (1); Zhou, Ye (1); Tan, Jianjun (1); Zeng, Zhuang (1)
Source: *Tribology International*, v 204, April 2025; **ISSN:** 0301679X; **DOI:** 10.1016/j.triboint.2024.110496; **Article number:** 110496; **Publisher:** Elsevier Ltd
Author affiliation: (1) State Key Laboratory of Mechanical Transmission for Advanced Equipment, Chongqing; 400044, China
Abstract: The new non-uniform distribution tilting-pad journal bearing and circular tilting-pad thrust bearing exhibit significant potential for high-power wind turbine main drives due to their high load-bearing capacity and block-structure easy maintenance. However, the dynamic performance data for these innovative bearings in dual-sliding-bearing main shaft system are currently lacking. A novel 5-DOF tribo-dynamics model is developed to analyze bearing coupling performance and interactions with rotor vorticity. Results reveal that bearing clearance (BC) and bearing support positions substantially impact dynamic performance. Notably, variations in BC from 0.46 mm to 0.52 mm leads to differing trends in film pressure fluctuations, affecting stability. These findings provide theoretical support and data analysis for optimizing bearing design and enhancing the reliability of main transmission systems. © 2025 (70 refs)
Main heading: Wind turbines
Controlled terms: Bearing pads - HVDC power transmission - Journal bearings - Thrust bearings
Uncontrolled terms: Bearing clearance - Bearing layout - Dynamic performance - Main-shaft - Non-uniform distribution - Nonuniform distribution pad - Shaft system - Sliding bearing - Tilting-pad journal bearings - Tribodynamic
Classification Code: 601.2 Machine Components - 706.1.1 Electric Power Transmission - 1008.5 Wind Power and Wind Power Generation
Funding Details: Number: 2022YFB4201100, Acronym: NKRDPC, Sponsor: National Key Research and Development Program of China; Number: -, Acronym: NKRDPC, Sponsor: National Key Research and Development Program of China;
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Database: Compendex
Data Provider: Engineering Village

10. Dynamic stiffness analysis of angular contact ball bearings based on fully coupled bearing-rotor dynamic model

Chen, Kang (1); Wang, Liqin (1, 2); Bao, Maokuan (1); Wu, Jiqiang (1); Li, Zhen (1)
Source: *Mechanical Systems and Signal Processing*, v 253, June 1, 2026; **ISSN:** 08883270, **E-ISSN:** 10961216; **DOI:** 10.1016/j.ymssp.2026.114349; **Article number:** 114349; **Publisher:** Academic Press
Author affiliation: (1) School of Mechatronics Engineering, Harbin Institute of Technology, Harbin; 150001, China (2) State Key Laboratory of Robotics and System, Harbin Institute of Technology, Harbin; 150080, China
Abstract: A fully coupled dynamic model of a ball bearing-rotor system is developed and experimentally validated to investigate the interaction between bearing internal dynamics and rotor vibration. The model resolves bearing contact forces and moments directly from internal dynamics, enabling the dynamic stiffness to evolve naturally with rotor motion. Results

show that the dynamic stiffness of angular contact ball bearings exhibits pronounced non-stationary behavior, in which low-frequency variations induced by rotor load modulation coexist with high-frequency fluctuations transmitted through the rolling elements. These stiffness fluctuations demonstrate that bearing stiffness is continuously modulated by rotor dynamics rather than being an intrinsic local property. At high rotational speeds and low axial loads, additional inertial loads induced by rotor vibration significantly degrade effective bearing stiffness and destabilize ball-raceway contacts. Based on this mechanism, a stiffness-based criterion is proposed to characterize the limiting speed governed by internal bearing dynamics. Furthermore, stiffness variations have a limited influence on low-order rotor modes but strongly affect higher-order modes, leading to shifts in hazardous operating speed ranges and modulation of rotor vibration responses. (37 refs)
Main heading: Dynamic models
Controlled terms: Angular contact ball bearings - Data mining - Roller bearings - Stiffness - Vibrations (mechanical)
Uncontrolled terms: Angular contacts - Bearing rotor interaction - Bearing rotors - Bearing stiffness - Dynamic stiffness - Dynamics models - Fully-coupled - Internal dynamics - Limiting speed - Rotor vibrations
Classification Code: 214 Materials Science - 601.2 Machine Components - 1106.2.1 Data Mining - 1301.1.1 Mechanics - 1301.7 Statistical and Nonlinear Physics
Funding Details: Number: 52405183, Acronym: -, Sponsor: National Natural Science Foundation of China; Number: 52575204, Acronym: -, Sponsor: National Natural Science Foundation of China;
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Database: Compendex
Data Provider: Engineering Village

11. Enhancing the bearing capacity of tilting pad thrust bearings based on tilting pad's sliding area distribution optimized by genetic algorithm

Le, Vanquynh (1); Nguyen, Vanliem (2); Nguyen, Minhchau (3); Nguyen, Thihongngoc (4); Li, Tao (5); Su, Beibei (6)
Source: *Industrial Lubrication and Tribology*, p 1-8, 2025; **ISSN:** 00368792, **E-ISSN:** 17585775; **DOI:** 10.1108/ILT-05-2025-0218;
Publisher: Emerald Publishing, Article in Press
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Abstract: Purpose – The purpose of this paper is the study of the distribution between the sliding and non-sliding regions of sliding/non-sliding pairs to improve the bearing capacity (W) of tilting pad thrust bearings (TPTB). Design/methodology/approach – Based on the TPTB's structure using six tilting pads, a hydrodynamics model of a tilting pad is established to calculate the pressure of the liquid film (p). At the boundary line between the sliding and non-sliding regions of the tilting pad, the mesh nodes are then established and optimized to improve the W of TPTB based on a genetic algorithm. Findings – The optimization results show that, with the boundary line between the sliding and non-sliding regions distributed by the quadratic curve, when the liquid flows through the optimal sliding/non-sliding surfaces of these tilting pads, the p is significantly increased compared to p of the sliding/non-sliding regions distributed in a straight line. This helps to increase the pressure on more areas of the tilting pad surfaces. As a result, W of TPTB using the sliding/non-sliding region with the optimal boundary line is higher than W of TPTB using the sliding/non-sliding region with the straight boundary line and ignoring the sliding region by 11.4% and 42.8%, respectively. Originality/value – Therefore, this optimization result should be referred and applied in the design of the sliding and non-sliding regions in tilting pad surfaces of TPTB to improve its working efficiency. Peer review – The peer review history for this article is available at: Link to the website of Web Science. (22 refs)
Main heading: Bearing capacity
Controlled terms: Bearing pads - Curve fitting - Thrust bearings
Uncontrolled terms: Boundary lines - Liquid pressure - Optimisations - Peer review - Sliding regions - Sliding/non-sliding - Thrust pad bearings - Tilting pad - Tilting pad thrust pad bearing - Tilting-pad thrust bearings
Classification Code: 214.1 Mechanical Properties of Materials - 601.2 Machine Components - 1106 Computer Software, Data Handling and Applications - 1201.7 Optimization Techniques - 1201.9 Numerical Methods
Database: Compendex
Data Provider: Engineering Village

12. Dynamic analysis of the elastic ring squeeze film damper rotor system with bearing angular misalignment

Liang, Baobing (1, 2); Luo, Zhong (1, 2); Sun, Kai (3); Li, Lei (1, 2); Wu, Xuanrui (1, 2); Zhao, Boyu (1, 2); Dong, Fuzheng (1, 2)
Source: *Mechanical Systems and Signal Processing*, v 250, April 15, 2026; **ISSN:** 08883270, **E-ISSN:** 10961216; **DOI:** 10.1016/j.ymssp.2026.114175; **Article number:** 114175; **Publisher:** Academic Press
Author affiliation: (1) School of Mechanical Engineering and Automation, Northeastern University, Shenyang; 110819, China (2) Key Laboratory of Vibration and Control of Aero-Propulsion Systems Ministry of Education of China, Northeastern University, Shenyang; 110819, China (3) School of Mechanical Engineering, Northeast Electric Power University, Jilin; 132014, China
Abstract: The elastic ring squeeze film damper (ERSFD), with its excellent vibration suppression performance, has been applied in rotating machinery systems such as aero-engines. As essential components in rotating machinery, rolling bearings directly shape the dynamics of rotor systems. Due to installation errors and other factors, bearings are prone to angular misalignment faults. However, investigation into ERSFD-rotor systems with bearing angular misalignment is still insufficient. In this paper, a model capturing ERSFD-rotor system dynamic behavior accounting for bearing misalignment was established using the finite element method and lumped-mass method. Subsequently, bearing angular misalignment effects on ERSFD system vibrations and bearing contact characteristics were investigated. Partial simulation results were experimentally validated using a rotor test rig. Results indicate that the ERSFD effectively suppresses vibrations caused by bearing misalignment, reduces ball contact deformation, and reduces both ball contact forces and bearing force fluctuations. © 2026 Elsevier Ltd. All rights are reserved, including those for text and data mining, AI training, and similar technologies. (47 refs)
Main heading: Dynamic analysis
Controlled terms: Aircraft engines - Alignment - Angular contact ball bearings - Roller bearings - Rotating machinery
Uncontrolled terms: Angular misalignment - Bearing angular misalignment - Bearing contact - Bearing contact characteristic - Contact characteristics - Dynamics analysis - Elastic ring squeeze film damper - Elastic rings - Experimental validations - Rotor systems - Squeeze-film dampers
Classification Code: 215.1.2 Mechanical Properties Testing Methods - 601.1 Mechanical Devices - 601.2 Machine Components - 653 Aircraft Engines
Funding Details: Number: 2023A1515110557, Acronym: -, Sponsor: Basic and Applied Basic Research Foundation of Guangdong Province; Number: 2023-BSBA-102, Acronym: -, Sponsor: Natural Science Foundation of Liaoning Province; Number: 12272089,52405095, Acronym: NNSFC, Sponsor: National Natural Science Foundation of China; Number: WZKF-2024-6, Acronym: -, Sponsor: -; Number: 2024GKLACVTKF07,N2403022, Acronym: -, Sponsor: Fundamental Research Funds for the Central Universities; Number: JYTQN2023162, Acronym: -, Sponsor: Department of Education of Liaoning Province;
Funding text: This research was funded by the National Natural Science Foundation of China, grant number 12272089 and 52405095; Guangdong Basic and Applied Basic Research Foundation, grant number 2023A1515110557; Natural Science Foundation of Liaoning Province, grant number 2023-BSBA-102; the Fundamental Research Funds for the Central Universities of China, grant numbers N2403022; Open Project of Guangxi Key Laboratory of Automobile Components and Vehicle Technology in 2024, grant number 2024GKLACVTKF07; the Basic Research Projects of Liaoning Provincial Department of Education, grant number JYTQN2023162; Open Fund of National Key Laboratory of Particle Transport and Separation Technology, grant number WZKF-2024-6.
Database: Compendex
Data Provider: Engineering Village

13. Magneto-Rheological (MR) lubrication of sectorial thrust pad hybrid bearing

Kumar, Narendra (1); Sharma, Satish C (1); Chauhan, Nathi Ram (2)
Source: *Proceedings of the Institution of Mechanical Engineers, Part J: Journal of Engineering Tribology*, v 240, n 5, p 753-770, May 2026; **ISSN:** 13506501, **E-ISSN:** 2041305X; **DOI:** 10.1177/13506501251362082; **Publisher:** SAGE Publications Ltd
Author affiliation: (1) Department of Mechanical and Industrial Engineering, Tribology Laboratory, Indian Institute of Technology, Roorkee, India (2) Department of Mechanical and Automation Engineering, Indira Gandhi Delhi Technical University for Women, Delhi, India
Abstract: The use of smart lubricants in fluid film bearing applications has gained enormous popularity. This study presents a numerical model to predict the behavior of a magneto-rheological (MR) lubricated hybrid sectorial thrust pad bearing system. The Finite Element Method (FEM) has been used to solve the modified Reynolds equation, which describes the sectorial thrust pad hybrid bearing. A constitutive relation based on the Bingham model is used to simulate the flow behavior of the MR lubricant. The computational results reveal that increasing the number of sectors in the magneto-rheological (MR) lubricated sectorial thrust pad bearing enhances the pocket pressure, load-carrying capacity, and stiffness coefficient. © IMechE 2025 (59 refs)
Main heading: Finite element method
Controlled terms: Bearing pads - Bearings (structural) - Lubricants - Lubrication - Magnetos - Reynolds equation - Thrust bearings

Uncontrolled terms: Capillary compensating device - Compensating devices - Element method - Hybrid bearings - Lubrication / - Magneto-rheological lubricant - Magnetorheological - Sector thrust pad - Smart lubricants - Thrust pad bearings
Classification Code: 301.1 Fluid Flow - 408 Structural Design - 408.1 Structural Members and Shapes - 601.2 Machine Components - 606.1 Lubricants - 606.2 Lubrication - 705.2 Electric Generators - 708.4 Magnetic Materials - 1201.2 Calculus and Analysis - 1201.9 Numerical Methods
Database: Compendex
Data Provider: Engineering Village

14. Experimental Studies of a Damper Thrust Bearing with a Hydrostatic Leveling System to Determine Improved Parameters of Its Structural Design

Martsynkovskyy, Vasyl (1); Liubchenko, Kostiantyn (1); Prokopenko, Andrii (1); Lazarenko, Andrii (2)
Source: *Lecture Notes in Mechanical Engineering*, p 35-44, 2026, *Advances in Hydraulic and Pneumatic Drives and Control, Centrifugal Pumps, Valves, and Seals, 2025*; **ISSN:** 21954356, **E-ISSN:** 21954364; **ISBN-13:** 9783032073914; **DOI:** 10.1007/978-3-032-07392-1_4; **Conference:** 21st International Scientific-Technical Conference on Hydraulic and Pneumatic Drives and Control, Centrifugal Pumps, Valves, and Seals, NSHP 2025, October 7, 2025 - October 10, 2025; **Publisher:** Springer Science and Business Media Deutschland GmbH
Author affiliation: (1) TRIZ LTD, Mashynobudivnykiv str. 1, 40020, Sumy, Ukraine (2) Karlsruhe Institute of Technology, Kaiserstr. 12, 76131, Karlsruhe, Germany
Abstract: The article presents the development and experimental study of a thrust sliding bearing with a self-generating hydrostatic leveling and damping system, designed to replace outdated traditional leveling systems for thrust bearings in rotor machines. The necessity of improving the reliability and efficiency of thrust bearings subjected to asymmetric loads is emphasized, as such loads lead to accelerated wear of load-bearing elements and emergency failures of dynamic equipment. An analysis of existing axial load leveling methods, including mechanical lever systems and hydrostatic leveling with an external pressure supply, has been conducted. It has been established that traditional solutions have several drawbacks, such as structural and operational complexity, significant axial subsidence of mechanical leveling systems, wear of load-bearing elements, and limited vibration damping efficiency. In this regard, a new bearing design with a hydrostatic leveling and damping system has been proposed, ensuring uniform load distribution and effective axial vibration reduction. Experimental studies have identified the preferred parameters of the bearing's structural elements. The obtained research results confirmed the high efficiency of the developed design, allowing the elimination of traditional solution drawbacks and significantly improving the operational characteristics of bearings in rotor machines. Based on the optimization of structural elements, recommendations have been formulated for the design of a thrust sliding bearing with a self-generating hydrostatic leveling and damping system. © The Author(s), under exclusive license to Springer Nature Switzerland AG 2026. (14 refs)
Main heading: Structural design
Controlled terms: Axial loads - Bearings (structural) - Damping - Efficiency - Hydraulics - Hydrostatic bearings - Leveling (machinery) - Rotors - Structural optimization - Thrust bearings - Vibrations (mechanical) - Wear of materials
Uncontrolled terms: Asymmetric axial load - Damping capacity - Damping system - Leveling system - Levelings - Load-bearing elements - Mechanical - Rotor machine - Sliding bearing - Thrust sliding bearing
Classification Code: 214 Materials Science - 408 Structural Design - 408.1 Structural Members and Shapes - 601.2 Machine Components - 913.1 Production Engineering - 1201.7 Optimization Techniques - 1301.1.1 Mechanics - 1401.1 Hydraulics
Database: Compendex
Data Provider: Engineering Village

15. Experimental and numerical study on the load-bearing characteristics of composite elliptical pressure vessel heads under hydrostatic pressure

Wang, Shuo (1); Zhao, Xinyang (1); Mei, Zhiyuan (1); Peng, Ying (1); Chen, Guotao (1)
Source: *Thin-Walled Structures*, v 218, January 2026; **ISSN:** 02638231; **DOI:** 10.1016/j.tws.2025.114068; **Article number:** 114068; **Publisher:** Elsevier Ltd
Author affiliation: (1) Naval University of Engineering, Wuhan; 430033, China
Abstract: The present study investigated the load-bearing characteristics and layup optimization of composite elliptical pressure vessel heads under hydrostatic pressure, both experimentally and numerically. By performing synchronized strain measurements on inner and outer surfaces, we provide the first direct experimental evidence that structural failure arises primarily from root bending moments, easily lead to meridional compression failure (maximum experiment-simulation deviation: 10 %). Through parametric finite element analysis, it was found that the $[\pm\theta0]s$ layup with $\theta0$ = 42° has the optimal ultimate bearing capacity, and the fiber compression failure of this layup can maximize the compressive resistance.

Crucially, a stress-matched [circumferential/meridional]s optimization strategy was proposed, reducing maximum circumferential stress by 28.76 % and meridional stress by 42.67 % while enhancing ultimate bearing capacity by 46.41 % versus quasi-isotropic layups. These findings establish new design paradigms for lightweight deep-sea pressure vessels. © 2025 Elsevier Ltd (26 refs)
Main heading: Hydrostatic pressure
Controlled terms: Bearing capacity - Failure (mechanical) - Failure modes - Fiber reinforced plastics - Hydraulics - Hydrostatic bearings - Loads (forces) - Outages - Safety engineering
Uncontrolled terms: Bearing characteristic - Compression failure - Elliptical pressure vessel head - Ellipticals - Experimental and numerical studies - Fibre-reinforced composite - Layup optimization - Load-bearing - Ultimate bearing capacity - Vessel heads
Classification Code: 205.1 Polymeric Materials - 214 Materials Science - 214.1 Mechanical Properties of Materials - 301.2 Hydrodynamics - 408 Structural Design - 601.2 Machine Components - 706.1.2 Electric Power Distribution - 914 Safety Engineering - 1401.1 Hydraulics
Funding text: The authors gratefully acknowledge the financial support provided by Naval pre-research project of China [grant nos. 2023138/2067], Naval University of Engineering independently developed research project (No. 2025505100) and Naval University of Engineering independently developed research project (No. 2023505080).
Database: Compendex
Data Provider: Engineering Village

16. Investigation of Rectangular Dimple Textured Thrust Pad Bearing Using Artificial Neural Network

Sirohi, Dhanishta (1); Aggarwal, Shipra (1)
Source: *Lecture Notes in Networks and Systems*, v 1725 LNNS, p 134-141, 2026, *Data Science and Applications - Proceedings of ICDSA 2025*; **ISSN:** 23673370, **E-ISSN:** 23673389; **ISBN-13:** 9783032109392; **DOI:** 10.1007/978-3-032-10940-8_11; **Conference:** 6th International Conference on Data Science and Applications, ICDSA 2025, July 16, 2025 - July 18, 2025; **Publisher:** Springer Science and Business Media Deutschland GmbH
Author affiliation: (1) Department of Mechanical and Automation Engineering, Indira Gandhi Delhi Technical University for Women, Kashmere Gate, Delhi, India
Abstract: Texture is employed on the pad's surface to improve the performance behaviour of thrust pad bearings. This paper investigates the performance parameters (pressure, load carrying capacity and coefficient of friction) of a rectangular dimpled pad thrust bearing. The effect of dimples' attributes, such as depth, texture area density, circumferential extent and radial extent, has been explored. The Reynolds equation is solved to compute the performance behaviours for few cases of dimple parameters varying within the given range, yielding the output. An artificial neural network model is trained to predict the performance parameters. It has been investigated that a textured pad having rectangular dimples having a depth of 20 µm, area density of 0.5625, circumferential and radial extent in the range of 0.6–0.8 obtained higher load carrying capacity and lower friction coefficient in comparison to other cases considered in the investigation. The simulated model shows good accuracy and predicts the performance parameters with less than 2% error. Overall, the research showcases the potential of artificial neural networks in predicting bearing performance behaviours. © The Author(s), under exclusive license to Springer Nature Switzerland AG 2026. (22 refs)
Main heading: Friction
Controlled terms: Bearing pads - Load limits - Loads (forces) - Thrust bearings - Tribology
Uncontrolled terms: Artificial neural network modeling - Coefficient of frictions - Load carrying - Neural-networks - Performance - Performance parameters - Pressure load - Reynolds's equations - Texture area density - Thrust pad bearings
Classification Code: 101.1 Biomedical Engineering - 301.1 Fluid Flow - 408 Structural Design - 601.2 Machine Components - 606 Lubrication and Tribology - 1101 Artificial Intelligence - 1201.2 Calculus and Analysis - 1301.1.1 Mechanics
Database: Compendex
Data Provider: Engineering Village

17. Transfer twin support matrix machine using rescaled pinball loss for roller bearing fault diagnosis

Wang, Meng (1, 3); Gao, Jingwei (2); Tang, Anbo (1); Pan, Haiyang (1)
Source: *Measurement Science and Technology*, v 36, n 1, January 31, 2025; **ISSN:** 09570233, **E-ISSN:** 13616501; **DOI:** 10.1088/1361-6501/ad8fc4; **Article number:** 016167; **Publisher:** Institute of Physics
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Abstract: The support matrix machine (SMM) takes matrix-based data as input elements, which can protect the structural information of matrix-based data extracted from vibration signals and has good classification performance. However,

in practical applications, due to the limitation of mechanical equipment and monitoring technology, there is often an insufficient number of annotation samples for SMM to find the optimal hyperplane. Therefore, a novel transfer twin SMM (TTSMM) is proposed in this article. In TTSMM, the structural information from the source data is transferred to the target model by simultaneously training on both the source and target data, which helps to establish a high-performance model using a limited number of labeled samples. Furthermore, a rescaled pinball loss function is used in TTSMM, which is bounded and utilizes quantile distance to further improve the generalization ability of the model. Finally, the proposed method is implemented on two kinds of roller bearing fault data sets including the variable speed vibration signal from Anhui University of Technology (AHUT) and the constant speed vibration signal from Case Western Reserve University (CWRU). The experimental results show that TTSMM effectively utilizes samples from both the source and target domains for modeling and has superior classification ability with a limited number of labeled samples. (33 refs)
Main heading: Rollers (machine components)
Controlled terms: Ball bearings - Roller bearings - Transfer matrix method
Uncontrolled terms: Bearing fault diagnosis - Classification performance - Faults diagnosis - matrix - Rescaled pinball loss - Roller bearing fault - Structural information - Support matrix - Transfer twin support matrix machine - Vibration signal
Classification Code: 601.2 Machine Components - 1201 Mathematics
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Database: Compendex
Data Provider: Engineering Village

18. Dynamic Characteristics of Hydrostatic Thrust Bearing With Tilting Oil Pad Under Eccentric Load

Yu, Xiaodong (1); Du, Boyu (1); Meng, Xiuli (2); Qiao, Wenzhuo (1); Sun, Yankun (1); Ma, Wenjie (1); Sun, Kaixuan (1); Dai, Ruichun (3); Jia, Wentao (3); Jiao, Jianhua (4); Wang, Junfeng (4); Jiang, Hui (5)
Source: *Journal of Tribology*, v 147, n 9, September 1, 2025; **ISSN:** 07424787, **E-ISSN:** 15288897; **DOI:** [10.1115/1.4067660](https://doi.org/10.1115/1.4067660); **Article number:** 091104; **Publisher:** American Society of Mechanical Engineers (ASME)
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Abstract: During the processing of heavy machine tools, due to the effect of eccentric load, the oil film thickness changes, which directly affects the lubrication performance of the bearing. Therefore, this study takes the tiltable double rectangular oil pad hydrostatic thrust bearing as the research object and explores its dynamic characteristics. The study involves the analysis of oil film displacement response under eccentric loading conditions at different offset distances, loads, and sudden loads. Through analysis, the oil film damping coefficient and oil film dynamic stiffness of each oil cavity can be determined under different offset distances and loads. The research results show that the change in oil film thickness has a significant effect on the oil film stiffness. As the oil film thickness increases, the stiffness decreases, the ability to resist deformation becomes weaker, and the displacement response time becomes longer. Moreover, the dynamic stiffness is affected by the offset distance and the loading frequency. When the offset distance is 200 mm, the load is 24 tons, and the loading frequency is 50 rad/s, the oil film stiffness of the oil cavity 1 reaches 180 × 108 N/m. It is worth noting that the increase in dynamic stiffness of the sinking side is significantly greater than that of the floating side. Ultimately, this study provides a theoretical reference for evaluating the stability of hydrostatic thrust-bearing systems under eccentric loads. (29 refs)
Main heading: Friction
Controlled terms: Film thickness - Hydraulics - Hydrodynamics - Hydrostatic bearings - Loading - Lubricating oils - Lubrication - Machine tools - Stiffness - Thrust bearings
Uncontrolled terms: Bearing - Damping coefficients - Dynamics characteristic - Eccentric loads - Hydrodynamic lubrication - Hydrostatic thrust bearings - Oil film damping coefficient - Oil film stiffness - Oil films - Tilting oil pad
Classification Code: 208.4 Thin films - 214 Materials Science - 301.2 Hydrodynamics - 601.2 Machine Components - 603 Machine Tools - 606.1 Lubricants - 606.2 Lubrication - 691.2 Materials Handling Methods - 1301.1.1 Mechanics - 1401.1 Hydraulics
Funding text: The Heilongjiang Provincial Natural Science Foundation of China (LH2024E079).
Database: Compendex
Data Provider: Engineering Village

19. Nonlinear vibration analysis of full-ceramic bearing-rotor systems with a ball defect considering thermal deformation

Wang, Zhan (1); Zhao, Rui (1); Wang, Zinan (1); Zhang, Ke (2); Gao, Liuwang (1); Liu, Zirui (1)
Source: *JVC/Journal of Vibration and Control*, 2026; **ISSN:** 10775463, **E-ISSN:** 17412986; **DOI:** 10.1177/10775463261417087;
Publisher: SAGE Publications Inc., Article in Press
Author affiliation: (1) School of Mechanical Engineering, Shenyang Jianzhu University, Shenyang, China (2) School of Mechanical Engineering, Shenyang University of Technology, Shenyang, China
Abstract: Full-ceramic bearings exhibit high stiffness and low deformation, but their brittle ceramic balls easily develop surface defects under cyclic stresses. To understand the influence of ball defects on the full-ceramic bearing-rotor system, an impact force excitation function is proposed, which considers both thermal deformation and ball defects. The defect size changes the contact deformation in the bearing, which consequently changes the contact force. Moreover, the impact force also affects the frictional force. These factors are incorporated into the dynamic model. The model describes a full-ceramic bearing-rotor system with a defect-ball. This study examines the effects of speed, thermal effects and defect dimensions on the nonlinear vibration of the system. Experimental validation is conducted using simultaneous temperature and vibration testing. The results indicate that thermal deformation expands the instability zone at high speeds; it also decreases the transition of motion states. As the ball defect size increases, the amplitudes of the relevant frequencies fb and fc and their combined frequencies in the spectrum increase. The experimental and simulation results agree, and the amplitude error of the ball impact frequency is 6.08%. This study provides a framework for analysing the dynamics of full-ceramic bearing-rotor systems. © The Author(s) 2026 (30 refs)
Main heading: Vibration analysis
Controlled terms: Ball bearings - Bearing pads - Bearings (structural) - Ceramic materials - Friction - Surface defects - Thermal effects
Uncontrolled terms: Ball defect - Bearing-rotor system - Defect size - Full ceramic bearings - High stiffness - High-low - Impact force - Non-linear vibrations - Nonlinear vibration analysis - Thermal deformation
Classification Code: 204.1 Ceramics - 208 Coatings, Surfaces, Finishes, Films and Deposition - 214 Materials Science - 215.2 Testing of Non-mechanical Properties of Materials - 302 Thermodynamics and Heat Transfer - 408 Structural Design - 408.1 Structural Members and Shapes - 601.2 Machine Components - 941.5 Mechanical Variables Measurements - 1301.1.1 Mechanics
Funding Details: Number: XLYC2203015, Acronym: -, Sponsor: -; Number: 52205117, Acronym: NNSF, Sponsor: National Natural Science Foundation of China; Number: 2024-MSLH-401,2025JH2/101300055, Acronym: -, Sponsor: Department of Science and Technology of Liaoning Province; Number: 2025110045-JH2/1018, Acronym: -, Sponsor: -;
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Database: Compendex
Data Provider: Engineering Village

20. Research on the vibration mechanism of TBM main bearing considering surface shape error

Cao, Ao (1); Gao, Hongli (1); Fan, Shuwei (2); Guo, Liang (1); Zhang, Jiangquan (3); Lei, Yuncong (1); You, Zhichao (4)
Source: *Mechanical Systems and Signal Processing*, v 241, December 1, 2025; **ISSN:** 08883270, **E-ISSN:** 10961216; **DOI:** 10.1016/j.ymssp.2025.113587; **Article number:** 113587; **Publisher:** Academic Press
Author affiliation: (1) School of Mechanical Engineering, Southwest Jiaotong University, Sichuan, Chengdu; 610031, China (2) Zhuzhou CRRC Times Semiconductor Co., Ltd, Hunan, Zhuzhou; 412001, China (3) Student Innovation Practice Center, Southwest Jiaotong University, Sichuan, Chengdu; 610031, China (4) School of Computing and Artificial Intelligence, Southwest Jiaotong University, Sichuan, Chengdu; 611756, China
Abstract: Main bearing plays a very important role in the TBM main driving system. Since the main bearing belongs to three-row cylindrical roller bearing, both the radial side and the thrust side will be affected by surface shape error. These shape error will induce abnormal vibration of the main bearing, resulting in degradation of the performance of the main bearing and reduction of service life. Aiming at the time-varying excitation and dynamic model of TBM main bearing excited by surface shape error on the radial and thrust side, a dynamics model of TBM main bearing considering surface shape error is established in this paper. The model takes into full consideration of the comprehensive influence of shape error of radial side raceway, thrust side raceway and rollers, and systematically analyzes the influence of key parameters such as order, amplitude, and wave number on the vibration response characteristics of the main bearing. The results show that the vibration degree of the main bearing is gradually enhanced with the increase of the surface shape error order. With the

increase of the radial side raceway waviness amplitude, the vibration level of the main bearing rises first and then tends to stabilize the fluctuation interval. The change in the thrust side raceway waviness amplitude first makes the vibration level of the main bearing fluctuate within a certain range, and then shows an increasing trend. In contrast, the increase of the radial side raceway roundness amplitude will cause the vibration of the main bearing to intensify, but its effect is smaller than the waviness. The effect of the thrust side raceway flatness amplitude is also relatively small. In terms of the wave number of shape error, when the wave number of the radial side raceway waviness is 0.5 times the number of radial rollers, the vibration level of the main bearing will peak, and the integer multiple relationship has the most significant impact. The vibration level of the main bearing will also peak when the wave number of thrust side raceway waviness is an integer multiple of the number of thrust rollers. In addition, surface shape errors have no effect on bearing defect characteristic frequencies. This paper further discusses the influence of uneven load condition on the vibration characteristics of the main bearing. © 2025 Elsevier Ltd (38 refs)

Main heading: Vibration analysis
Controlled terms: Dynamic models - Errors - Roller bearings - Rollers (machine components) - Surface defects - Thrust bearings
Uncontrolled terms: Driving systems - Dynamics models - Main bearings - Shape errors - Surface shape error - TBM main bearing - Vibration level - Vibration mechanisms - Vibration response - Wave numbers
Classification Code: 208 Coatings, Surfaces, Finishes, Films and Deposition - 601.2 Machine Components - 731.1.1 Error Handling - 941.5 Mechanical Variables Measurements - 1301.7 Statistical and Nonlinear Physics
Funding Details: Number: 2025ZDZX0014,2024ZHCG0178, Acronym: -, Sponsor: Sichuan Provincial Science and Technology Support Program; Number: 2025ZNSFSC1279, Acronym: -, Sponsor: Natural Science Foundation of Sichuan Province; Number: 2682025CX012, Acronym: -, Sponsor: Fundamental Research Funds for the Central Universities;
Funding text: This research was supported by Sichuan Science and Technology Program (2025ZDZX0014, 2024ZHCG0178), Natural Science Foundation of Sichuan (2025ZNSFSC1279), the Fundamental Research Funds for the Central Universities (2682025CX012)
Database: Compendex
Data Provider: Engineering Village

21. Dynamic modeling and validation of disk-drum rotor system with angular contact ball bearing considering parallel and angular coupling misalignment

Liu, Ming (1); Guan, Hong (1); Wang, Pengfei (1); Ma, Hui (1, 2, 3)
Source: *Communications in Nonlinear Science and Numerical Simulation*, v 160, September 2026; **ISSN:** 10075704; **DOI:** 10.1016/j.cnsns.2026.109938; **Article number:** 109938; **Publisher:** Elsevier B.V.
Author affiliation: (1) School of Mechanical Engineering and Automation, Northeastern University, Liaoning, Shenyang; 110819, China (2) Key Laboratory of Vibration and Control of Aero-Propulsion System Ministry of Education, Northeastern University, Liaoning, Shenyang; 110819, China (3) Foshan Graduate School of Innovation, Northeastern University, Guangdong, Foshan; 528312, China
Abstract: At present, the dynamic modeling of the bearing-disk-drum rotor system primarily faces two challenges: accurate representation of the rotor structure and dynamic characteristics of bearing misalignment. In terms of modeling accuracy, conventional methods often employ beam elements to construct finite element models, but these approaches fail to adequately capture the mass and stiffness distribution of complex shell structures such as conical shells. To bridge the gap, this study introduces a beam-shell coupling technique to construct a finite element model of the disk-drum rotor that includes conical shell structures, thereby enabling a more realistic representation of the dynamic characteristics of the structure. For bearing misalignment, considering the unavoidable manufacturing and assembly errors in engineering practice, a five-degree-of-freedom nonlinear restoring force model based on Hertzian contact theory is developed. This model accounts for the coupled misalignment of the races in angular contact ball bearings and is integrated with the disk-drum rotor to construct a complete dynamic model. On this basis, numerical simulations are conducted to systematically analyze the influence of angular misalignment, parallel misalignment, and axial preload on the dynamic response of the system. The results reveal that, for angular contact ball bearings with zero initial clearance, all rolling elements remain under load when axial preload is applied. With the increase of the misalignment, the contact region of the bearing expands, the contact force increases, the response amplitude at the rotational frequency f r decreases, while the excitation frequency associated with bearing flexibility f vc increases. Furthermore, combination frequencies such as f r+ nf vc may also emerge. The findings of this study can provide a reference for health monitoring and fault diagnosis of angular contact ball bearing-rotor systems, and offer theoretical guidance for bearing selection and dynamic optimization design. © 2026 Elsevier B.V. (63 refs)
Main heading: Angular contact ball bearings
Controlled terms: Alignment - Bearing pads - Degrees of freedom (mechanics) - Disks (structural components) - Dynamic models - Dynamics - Roller bearings - Shells (structures) - Structural design

Uncontrolled terms: Angular contacts - Bearing disks - Bearing forces - Bearing-disk-drum rotor system - Drum rotors - Dynamics models - Finite element - Misalignment fault - Nonlinear bearing force - Rotor systems
Classification Code: 408 Structural Design - 408.1 Structural Members and Shapes - 601.1 Mechanical Devices - 601.2 Machine Components - 1301.1.1 Mechanics - 1301.7 Statistical and Nonlinear Physics
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Funding text: This research work is supported by the Natural Science Foundation of China (12572006) and the Guangdong Basic and Applied Basic Research Foundation of China (2024A1515240020).
Database: Compendex
Data Provider: Engineering Village

22. Design and performance evaluation of a 3D printed aerostatic bearing concept with high number of micro-orifices

Ağören, Görkem (1); Dal, Abdurrahim (2); Karaçay, Tuncay (1)
Source: *Proceedings of the Institution of Mechanical Engineers, Part J: Journal of Engineering Tribology*, v 239, n 4, p 509-524, April 2025; **ISSN:** 13506501, **E-ISSN:** 2041305X; **DOI:** 10.1177/13506501241295824; **Publisher:** SAGE Publications Ltd
Author affiliation: (1) Engineering Faculty, Mechanical Engineering Department, Gazi University, Ankara, Turkey (2) Engineering Faculty, Mechanical Engineering Department, Adana Alparslan Türkeş Science and Technology University, Adana, Turkey
Abstract: This study suggests a 3D printed aerostatic bearing concept. The design has a high number of orifices distributed around the bearing to obtain smoother pressure distribution for performance. Inner channels are formed to connect and feed air to each orifice using the advantage of additive manufacturing. The concept is investigated numerically to determine the performance gain of the high number of orifices by calculating bearing stiffness and load carrying capacity. In order to validate the simulation and performance gain an experimental study is conducted by testing Stereolithography (SLA) type 3D printed bearings with various orifice numbers. The bearing stiffnesses and mass flow rates of the specimens are measured, and results are discussed in terms of performance by comparing numerical results. The 3D printed bearings concept has shown promising results in terms of performance while keeping air consumption limited compared to conventional air bearings. © IMechE 2024. (37 refs)
Main heading: Orifices
Controlled terms: Hydrostatic bearings
Uncontrolled terms: Aerostatic bearings - Bearing loads - Bearing stiffness - Design evaluation - Load capacity - Load carrying - Micro-orifice - Performance - Performance Gain - Performances evaluation
Classification Code: 301.1 Fluid Flow - 601.2 Machine Components - 610.1 Pipe, Piping, and Pipelines
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Database: Compendex
Data Provider: Engineering Village

23. Capacitance Calculation of Cylindrical Roller Bearing—Modeling of the Cylinder Raceway and Cylinder Flange Contact (*Open Access*)

Manteufel, Jan (1); Puchtler, Steffen (2); Kirchner, Eckhard (1)
Source: *Lubricants*, v 14, n 4, April 2026; **E-ISSN:** 20754442; **DOI:** 10.3390/lubricants14040161; **Article number:** 161; **Publisher:** Multidisciplinary Digital Publishing Institute (MDPI)
Author affiliation: (1) Institute for Product Development and Machine Elements, Technical University of Darmstadt, Otto-Berndt-Str. 2, Darmstadt; 64287, Germany (2) HCP Sense GmbH, Robert-Bosch-Straße 7, Darmstadt; 64293, Germany
Abstract: A precise understanding of the electrical properties of bearings is of great interest in many areas of application, especially in the context of electrification. The understanding of electrical properties allows for damage detection and sensory utilization of bearings. Previous research into the capacitive properties of rolling bearings has been limited to ball bearings. Cylindrical roller bearings, which are predominantly used in applications with large radial loads, have not been investigated so far. This paper develops a method to calculate the capacitance of cylindrical roller bearings. The calculation of the raceway–surface contact capacitance is adapted from ball bearings. In addition, a calculation method for the electrical capacitance in the flange contact is derived. Both calculation methods account for the geometric and operating

conditions of the bearing and do not include any correction factors. To validate the calculation model, the capacitance of NU-208 and NJ-208 cylindrical roller bearings is measured and compared with the model results. © 2026 by the authors. (29 refs)
Main heading: Capacitance
Controlled terms: Ball bearings - Contacts (fluid mechanics) - Cylinders (shapes) - Cylindrical roller bearings - Damage detection - Flanges - Rollers (machine components)
Uncontrolled terms: Bearing modeling - Capacitance calculation - Cylindrical roller-bearing - Electrical capacitance - Flanges contacts - Lubrication / - Property - Raceway contact - Radial loads - Rolling bearings
Classification Code: 301.1 Fluid Flow - 408.1 Structural Members and Shapes - 601.2 Machine Components - 606.2 Lubrication - 610.1.1 Pipe Accessories - 701.1 Electricity: Basic Concepts and Phenomena - 913.3.1 Inspection
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Open Access type(s): All Open Access, Gold, Green
Database: Compendex
Data Provider: Engineering Village

24. Numerical investigation of pressure-equalizing groove configuration effects on gas bearing performance

Su, Yang (1); Wan, Fangjian (2); Wang, Lifang (1); Xiu, Hang (3); Qin, Qi (4)
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Abstract: High-speed rotating machinery has extremely high requirements for the performance and reliability of aerostatic bearings, and the design of pressure-equalizing groove structure is a key factor determining the performance of aerostatic bearings under high-speed conditions. At present, research on the influence of pressure-equalizing groove structure on the performance of high-speed aerostatic bearings is still relatively limited. In this study, aerostatic thrust gas bearings with three pressure-equalizing groove structures (rectangular, fan-shaped and drop-shaped) were designed, and their performance characteristics were comprehensively analyzed by numerical simulation method. A CFD model of the bearing was established based on the Navier-Stokes equations and the model accuracy was verified. The performance of bearings with each structure under different working conditions of air film thickness, supply pressure and rotational speed was explored. The study found that the shape of pressure-equalizing groove has a significant impact on the load-carrying capacity, pressure distribution, stiffness and stability of the bearing. Under high-speed conditions, vortices in the groove critically affect the pressure distribution in the high-pressure zone of the bearing, which in turn determines the load-carrying capacity. Fan-shaped and drop-shaped grooves can effectively suppress vortices due to their divergent structures, and their load-carrying capacity and stiffness during high-speed operation are superior to those of rectangular grooves, while rectangular and fan-shaped grooves have smaller pressure fluctuations and exhibit better stability. There is a clear correlation mechanism between the divergent characteristics of different pressure-equalizing grooves and vortex suppression. Fan-shaped and drop-shaped grooves can promote the expansion of the high-pressure area of the air film and enhance the hydrodynamic effect, while the complete vortex in the rectangular groove limits the development of the high-pressure area. The research results provide theoretical support for the design and optimization of aerostatic bearings, and contribute to the research and development of high-performance bearings adapted to high-speed rotating machinery. Copyright © 2026 Su, Wan, Wang, Xiu and Qin. (31 refs)
Main heading: Navier Stokes equations
Controlled terms: Aerodynamics - Airships - Computational fluid dynamics - Drops - Gas bearings - Gas lubricated bearings - High pressure effects - Hydrostatic bearings - Load limits - Loads (forces) - Pressure distribution - Rotating machinery - Thrust bearings - Vortex flow
Uncontrolled terms: Aerostatic bearings - Bearing performance - Gas bearing performance - Gas-lubricated hydrostatic bearing - High Speed - High-speed conditions - High-speed rotating - Load carrying - Pressure-equalizing groove
Classification Code: 301.1 Fluid Flow - 301.1.1 Liquid Dynamics - 301.1.3 Aerodynamics (fluid flow) - 301.1.4 Computational Fluid Dynamics - 301.2.2 Electrohydrodynamics - 408 Structural Design - 601.1 Mechanical Devices - 601.2 Machine Components - 606.2 Lubrication - 651 Aerodynamics - 652.5 Balloons and Gliders - 1201.2 Calculus and Analysis - 1201.4 Applied Mathematics - 1301.1.1 Mechanics - 1301.1.2 Physical Properties of Gases, Liquids and Solids
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25. A new model for bearing-rotor-disk coupling systems with localized failures

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Abstract: An accurate mathematical model serves as a fundamental analytical tool for examining the behavior response of mechanical systems. In order to investigate the kinetic behavior of a bearing-rotor-bearing coupled multibody system with localized failures, the mathematical models of flexible rotor and flexible disk based on Timoshenko beam theory and Kirchhoff plate theory are developed in this study, as well as the bearing model considering the time-varying misalignment factor. Then these components are integrated into a novel modeling framework for bearing-rotor-disk systems, which is employed for a detailed analysis of modal responses, operational mechanisms, and the effects of bearing faults and unbalance on system dynamics. The result demonstrates a pronounced coupling relation between rotor structure and rolling bearings, the rotor bending places the bearing in a persistently misaligned operational state, leading to the unavoidable generation of bearing contact angles. The maximum contact angle exceeds 10° when the rotor systems are operated under heavy-load and high-speed and conditions, and the bearing clearance becomes negative, resulting in severe degradation of system stability and nonlinear characteristics. Severe shock is produced due to the bearing raceway defect, and high-frequency fluctuations in bearing contact angle are generated as a result of oscillations in radial displacement of rollers, while the minimum clearance of the bearing is lost by 32.21%, and the contact stiffness is increased by 0.249%. The vortex motions of rotor system will be induced by unbalance faults, node orbit are characterized by circular geometry, and a positive linear correlation is observed between ball-ring contact frequency and rotor working frequency. © IMechE 2026 (36 refs)
Main heading: Contact angle
Controlled terms: Alignment - Bearing pads - Disks (machine components) - Disks (structural components) - Failure (mechanical) - Modal analysis - Particle beams - Roller bearings - System stability
Uncontrolled terms: Bearing contact - Bearing rotors - Bearing-rotor-disk coupled system - Behavior analysis - Coupled systems - Interference relationship - Localized failure - Rotor discs - Rotor systems - Theoretical modeling
Classification Code: 214 Materials Science - 408.1 Structural Members and Shapes - 601.1 Mechanical Devices - 601.2 Machine Components - 961 Systems Science - 1201.5 Computational Mathematics - 1301.1.2 Physical Properties of Gases, Liquids and Solids - 1301.2.1 High Energy Physics
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