ARMD™ – Advanced Rotating Machinery Dynamics – Software

BEARINGS Package

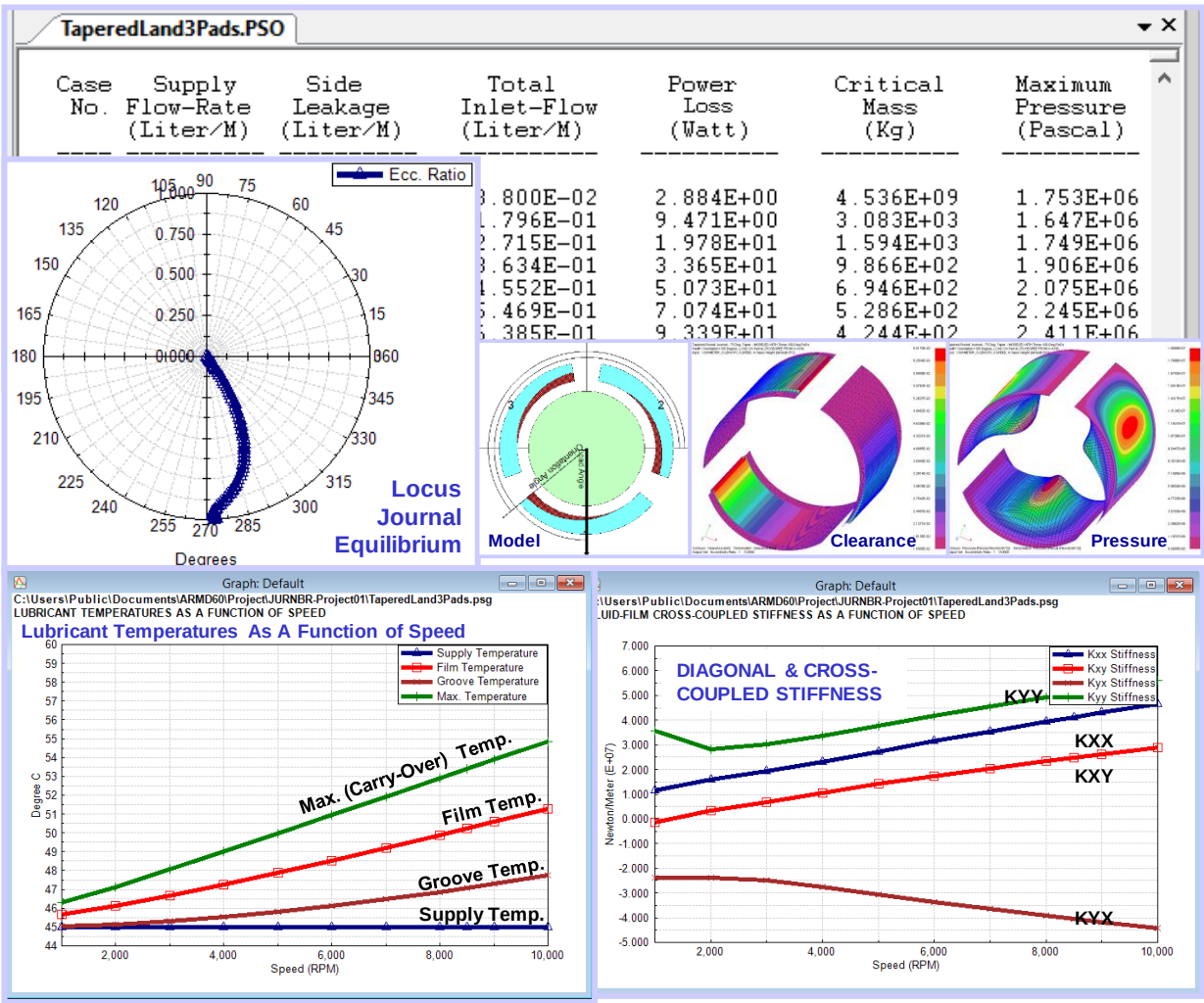
The **ARMD** software package is capable of facilitating comprehensive evaluations of fluid-film bearings. **Practically any bearing or bearing system available in the industry can be analyzed with one of the bearing solution modules**. The FLUID-FILM bearing modules (JURNBR, HYBCBR, THRSBR and TILTBR) solve the lubrication problem in two dimensions eliminating any approximation typically associated with one dimensional analysis or with look-up table methods.

- Journal
- Conical
- Thrust
- Tilting Pad

Complete performance predictions of hydrodynamic, hydrostatic, and hybrid lubricated journal, conical and thrust bearings operating in the laminar and/or turbulent regime can be generated. Simulation capabilities include effects such as cavitation, misalignment, pressurized boundaries, pressurized grooved feeding system, pressurized nozzle feeding system, surface/structural deviation, and lubricant feed circuitry (JURNBR, HYBCBR) with specified pressures or restrictors (capillary, orifice, or flow control valve), groove geometry and chamfers.

Results generated with the fluid-film bearing modules include:

- Load capacity / journal or runner position
- Attitude angle
- Viscous power loss
- Righting moments
- Flow requirements
- Stability (bearing whirl)
- Spring and damping coefficients
- Clearance and pressure distribution
- Recess pressures and flows
- Heat balance and temperature rises for bearing system and individual pads



ARMD™ Software – BEARINGS Package

Journal & Thrust Bearings
Fixed/Tilting Pad Geometries

- **Bearing Solver**
- **Post-Processor Single Case**
- **Post-Processor Multiple Case**

The release of RBTS' ARMD Version 6 fluid-film bearing modules is a major milestone in the product's development history, rolling out a **completely new and improved** graphical user interface for the package with enhanced numerical capabilities and new technical features. The software's front end was redesigned with our customers' and industry's input to incorporate the most logical, efficient, and productive techniques to model and analyze common as well as complex configuration, fluid-film lubricated journal and thrust bearings, of all sizes with ease.

ARMD users will immediately see the improvements as bearing design data are presented in a flatter, more accessible format, with key fields and analysis options readily visible from the main data entry screens. Fluid-film bearing design and performance evaluation productivity is vastly improved as a wide selection of templates accompanied by a "wizard" style sequence of dialogs allows the user to setup and evaluate most of the commonly used bearings in industry with few key strokes. Tab selected grids and input forms allow the user to see all of the data on screen at the same time. Furthermore, the ability to simultaneously run multiple instances of the program permits rapid side-by-side comparison of results.

Bearing configurations and special features that can be evaluated with the various solution modules include but not limited to:

Fixed Geometry Cylindrical and Conical Journal Bearings (JURNR & HYBCBR)

- Plain surface
- Multi-groove
- Pressure dam
- Elliptical or lemon
- Rayleigh step or pocket
- Tapered land
- Lobe or canted lobe
- Any configurable pad surfaces
- Multi-recess

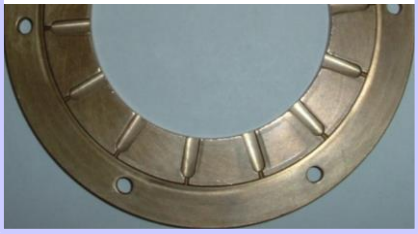
Tilting-Pad Journal Bearings (TILTBR)

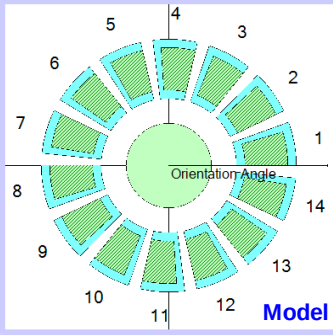
- Central pivot
- Offset pivot
- Evenly spaced pads
- Grouped pads
- Load between pads
- Load on pad
- Any load direction
- Any preload
- Leading/trailing edges taper
- Fluid-inertia force effects
- Support pivot stiffness

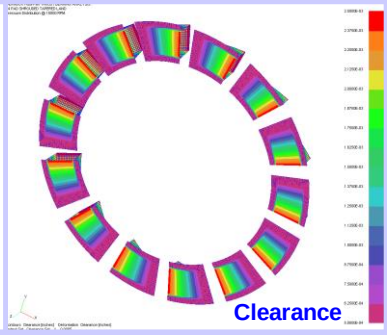
Fixed and Tilting-Pad Geometry Thrust Bearings (THRSBR)

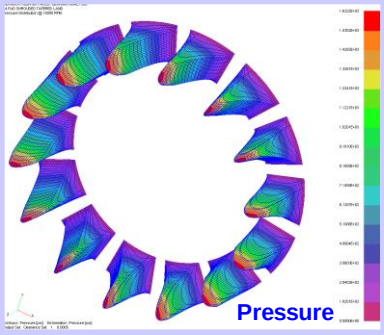
- Plain surface
- Multi-groove
- Step land
- Step pocket
- Tapered land
- Taper pocket
- Tilting pad
- Compound taper
- Any configurable pad surfaces

Sample Gearbox Thrust Bearing
14 pad shrouded tapered land configuration operating at 15KRPM

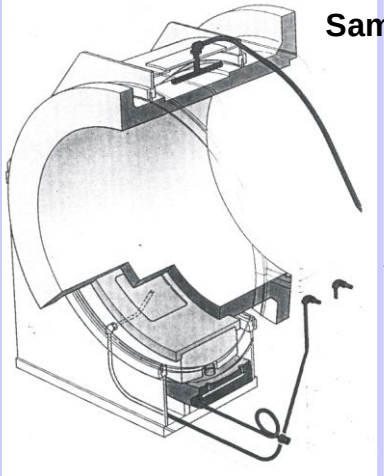


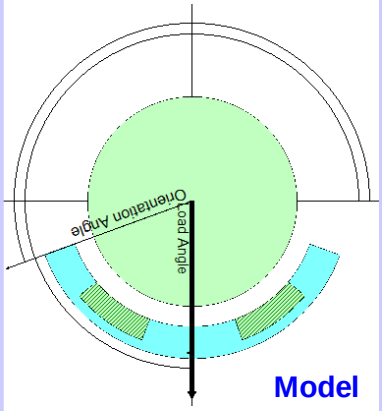


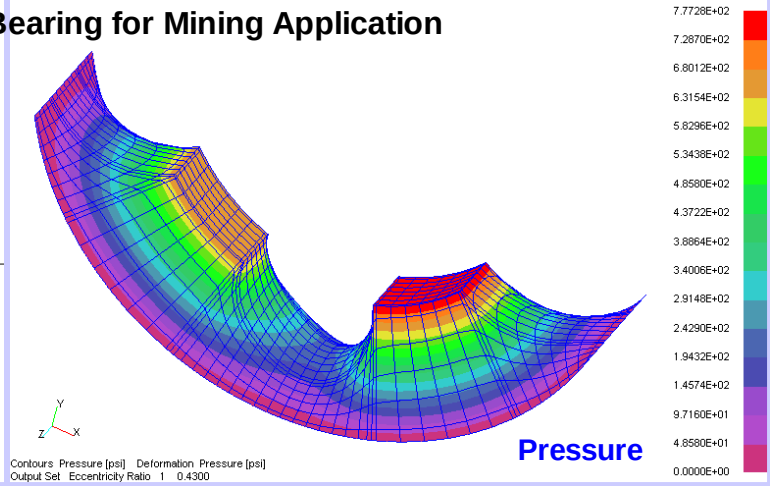




Sample Hydrostatic/Hybrid Bearing for Mining Application







ARMD™ Software – BEARINGS Package

Illustrated below, complete bearing performance results are generated when the Run button is pressed. The solution is performed for user specified operating conditions taking into consideration the pressurized feeding system. Heat balance is performed for the overall bearing system as well as individual pads in the bearing.

Modeled Bearing Details

Scroll through cases.

Complete Bearing Performance Results including bearing system and individual pad heat balance.

Pressure/ Clearance Distributions 3D View Button

Run Analysis

Generated text output after Run button is pressed

Post-Processor

Description

Sample Problem 6 - 5 Pad Tilting Pad Journal Bearing.
High Speed Test Rig Support Bearings.
Pad Pivot Stiffness NOT Included.

Diameter	3.5	Pad Angle	60.0	# of Pivot Clearances	50
Axial Length	2.5	Orientation Angle	0.0	Viscosity	1.000000e-06
Radial Clearance	0.004	Rotational Speed	20000.0	Full Matrix	☐

Single Case | Multiple Cases | Lubricant Properties

1 of 20 | Lube/Chamfer | Run | 3D

Operating Conditions

Clearance	0.004	Load	5000.0	Load Angle	270.0	Ort. Angle	90.0
Preload	0.4	Speed	20000.0	Grv. Angle	0.0	No. of Pads	5.0

```
Min.Film Thick.->   9.8316E-04 (Inch)|  ECC = 0.6344 @ Angle = 270.00 (Deg)
Power-Loss   --->   2.5591E+01 (HP)   |  Side-Leakage QF ->  1.7102E+00(Gpm)
Load Capacity -->   4.9955E+03 (Lbf)  |  Inlet-Flow   QI -> -1.5409E+01(Gpm)
|-------------------------------------|-------------------------------------|
Supply-Oil Temp.>  119.997   (Deg.F) |>>>   STIFFNESS (Lbf/Inch)
Supply Flow Rate>    6.1604  (Gpm)   |  KXX ; KXY -->  3.883E+06  1.229E+00
Film-Temp (avg.)>  176.056   (Deg.F) |  KYX ; KYY -->  1.690E+00  6.829E+06
Viscosity ------>  1.017E-06 (Rens)  |-------------------------------------|
Heat Content --->    3.622  (BTU/G/F)|>>>   DAMPING (Lbf-Sec/Inch)
Groove Temp. --->  165.765   (Deg.F) |  DXX ; DXY -->  1.637E+03  3.463E-04
Max. Temp.(avg.)>  186.347   (Deg.F) |  DYX ; DYY -->  1.420E-04  2.551E+03
|----Individual Pad Results Below-----|-------------------------------------|
Surface Velocity=  1.833E+04 (Ft/min)|  Projected Pressure=  5.709E+02 (PSI)
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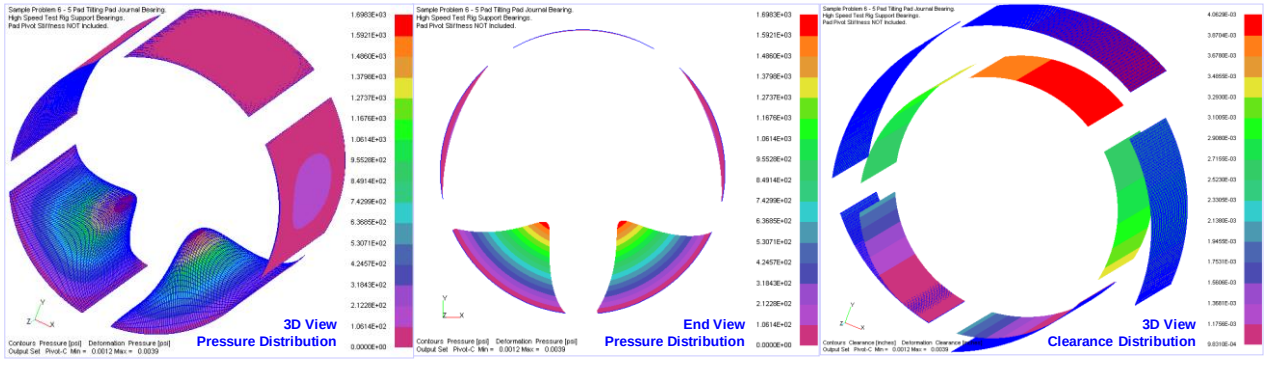
```
Individual Pad Heat Balance Results Estimate For NON-Flooded Environment
 Supply Flow Rate to Bearing = 6.1604E+00 (gpm) @ Ts = 1.2000E+02 (deg.F)
 Resulting in a Computed Mixed-Oil Exit Temperature -> 1.7064E+02 (deg.F)
 ------------------------------------------------------------------------

   Sump/Groove  Avg-Film     Max-Film     Min-Film      Power       Side
Pad Temperature Temperature  Temperature  Thickness     Loss        Leakage
No. (degree F.) (degree F.)  (degree F.)    (inch)      (hp)        (gpm)
--- ----------- -----------  ----------- ----------- ----------- -----------
 1   1.7247E+02  1.7550E+02   1.7853E+02  3.8107E-03  2.4191E+00  1.1370E-01
 2   1.6620E+02  1.7180E+02   1.7740E+02  2.5828E-03  3.3132E+00  3.9459E-01
 3   1.6167E+02  1.9445E+02   2.2723E+02  9.8316E-04  8.2725E+00  4.0366E-01
 4   1.7454E+02  2.0731E+02   2.4009E+02  9.8316E-04  8.2725E+00  4.0366E-01
 5   1.8108E+02  1.8668E+02   1.9228E+02  2.5828E-03  3.3132E+00  3.9459E-01
```

Ok | Cancel | Help



Purchasing Options

ARMD is constructed from various solution modules for rotating machinery/systems:

- **Rotor Dynamics**
- **Torsional Vibration**
- **Lubricant Analysis**
- **Fluid-Film Bearings**
- **Rolling-Element Bearings**

Tailored to suit your needs and budget. You may purchase any combination of programs/modules or all if you wish. Licensing is available as a single seat or multi-seat network configuration. With your purchase, the package includes software (CD or download), quick start manual, electronic user's manual, technology transfer and training session (optional), updates, maintenance, and support.

System Requirements

Computer with Microsoft Windows 8, 10, 11 or higher (32 or 64 bit).

Remember, with **RBTS**, you get more than just the programs, you get the company with more than 50 years of experience in the areas of tribology and machinery dynamics.

For further information, please contact us.

RBTS, Inc.

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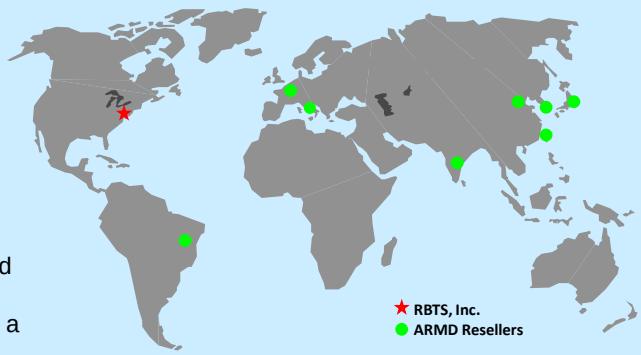
ARMD™ - The Worldwide Leading Software For Rotating Machinery Analysis

Advanced Rotating Machinery Dynamics

ARMD is a well established software package used worldwide to perform complete rotating machinery dynamic analysis. ARMD employs a user-friendly interface and window environment and context-sensitive help. ARMD integrates the most advanced and complete rotor dynamics, torsional vibration, and bearing analysis programs under one environment in a seamless fashion to give you the power to model your rotating machinery with ease, efficiency, and above all accuracy. Some applications in which ARMD has been utilized include rotating machinery such as a miniature air turbine for a dental drill, a large turbine generator set for a power plant, a small compressor for an air conditioner, a pump for an artificial heart, a fuel pump for a jet engine, an electric motor and spindle for a miniature computer hard disk, a canned pump for petrochemical processing plant, synchronous motor driven drive-trains, and gear boxes for a uranium enrichment plant and ship propulsion drives to name a few.



RBTS' software has gained international reputation for its:

- **Technical Capabilities**
- **Completeness**
- **User Friendliness**
- **Support & Service**

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YOUR PARTNER

for Europe & Middle East & Africa

Support for other countries on request.

- **Customer Engineering Support**
  (Rotor Dynamics & Torsional Vibrations)
- **ARMD Software Support**
- **Training Courses & Seminars**

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