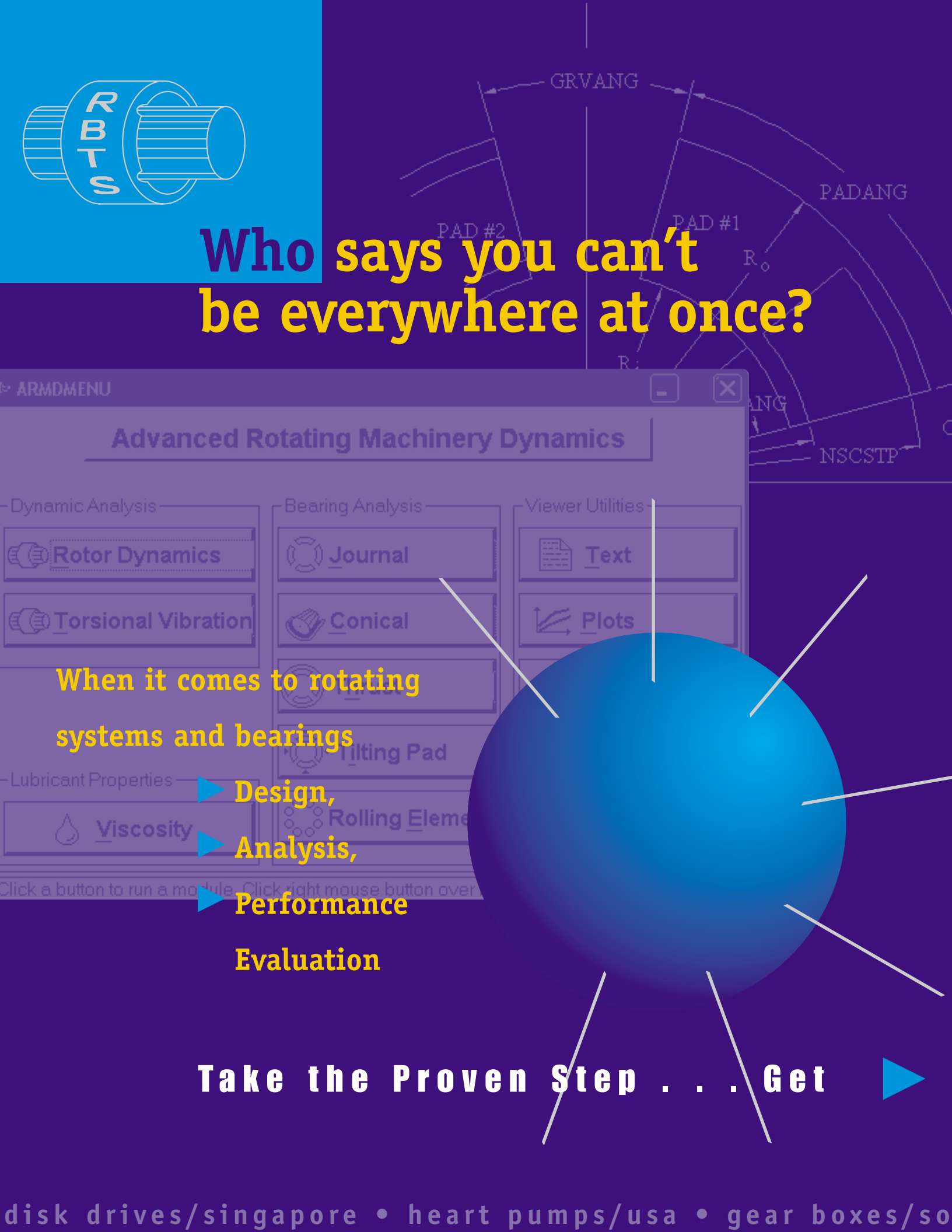



# Who says you can't be everywhere at once?

**When it comes to rotating systems and bearings**

- **Design,**
- **Analysis,**
- **Performance Evaluation**

**Take the Proven Step . . . Get**

# ...ARMD™

**A**dvanced
**R**otating
**M**achinery
**D**ynamics

Software for
machinery design,
analysis,
and troubleshooting

**ARMD** is the most complete software package available to help you evaluate any bearing, rotor/bearing system, or mechanical drive train. Using leading edge technology and a host of valuable capabilities, ARMD has been proven effective and accurate in the design, analysis and trouble shooting of rotating machinery by machinery manufacturers, equipment packagers and end users around the world.

**ARMD** consists of four main modules:

- Rotor Dynamics
- Torsional Vibration
- Lubricant Performance
- Bearing Analysis

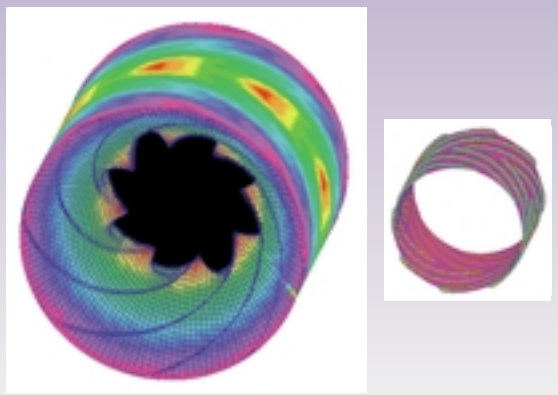
With a variety of features, including:

- A user-friendly interface
- Advanced project and file management system
- Graphics/text capabilities
- Intermodule communication and data exchange

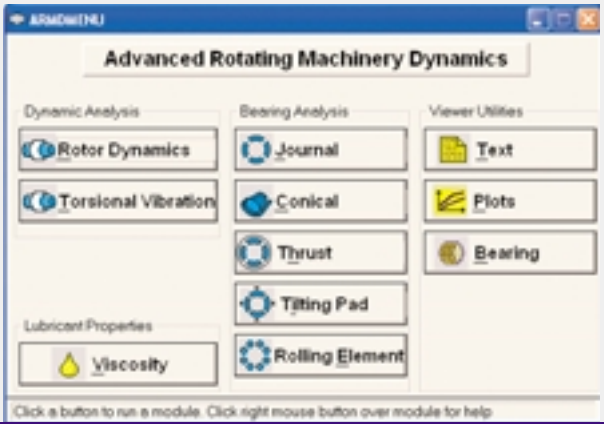
All of which operate seamlessly in an integrated environment.

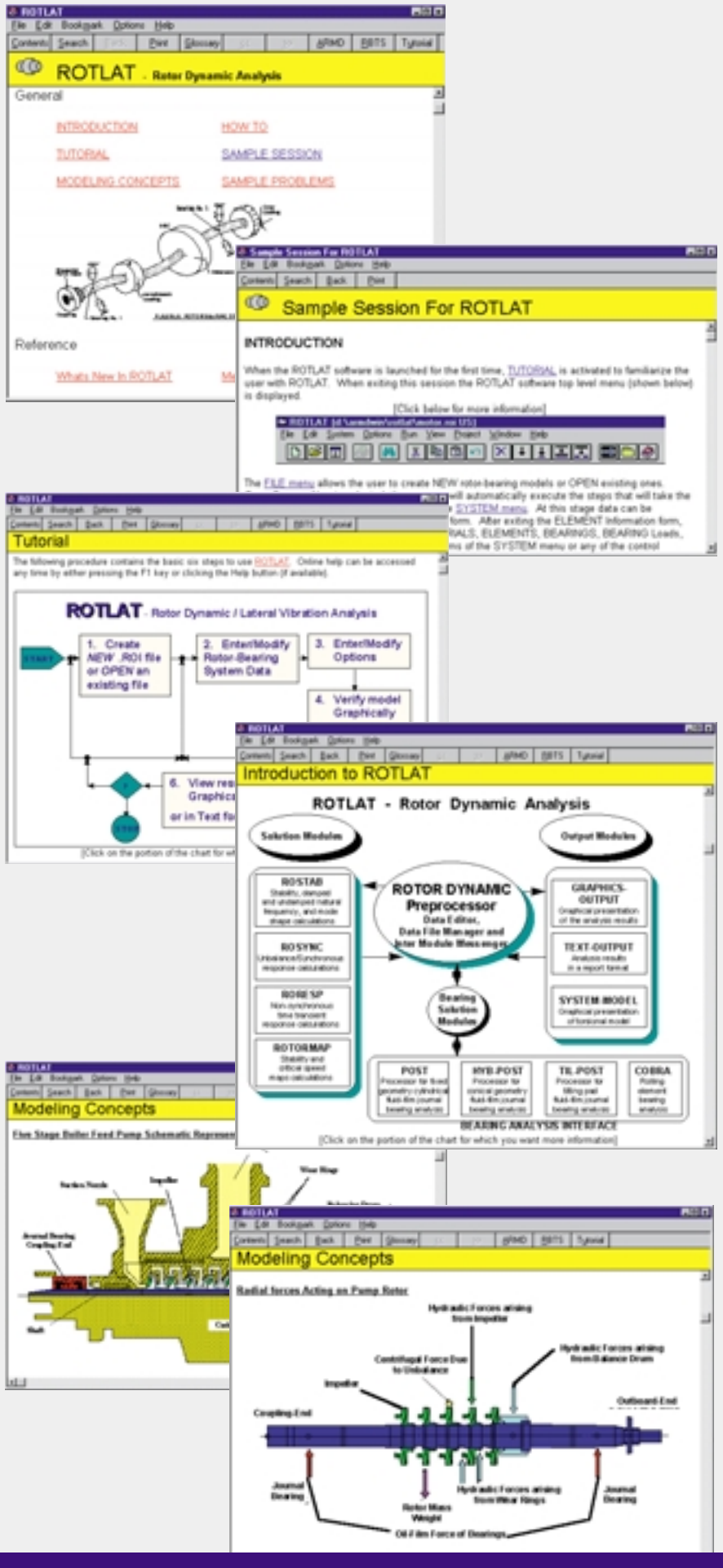
## Enhanced Capabilities and Features of ARMD for Windows

- Windows 9x, Me, NT4, 2000, XP or higher operating systems with support to:
  System clipboard Toolbars Status lines
  Accelerator keys Tooltips Bitmaps
- Numerous templates for rotor/bearing systems.
- Comprehensive on-line tutorial session in each module.
- Right-click mouse button for pop-up menus.
- Improved table forms:
  Auto append Duplicate Split
  Cut/Copy/Paste Status line Units/range
- Project management for grouping related files.
- Change/save/restore graph settings/templates.
- Improved graphics utility supporting FFT plots, spectrum plots, adjustable line thicknesses and fonts.
- Mode shape animation on graphical models.
- 3-dimensional presentation and animation of bearing performance.
- Query of elements, discs and bearings from graphical models.
- Numerous technical/modeling enhancements in the solvers.

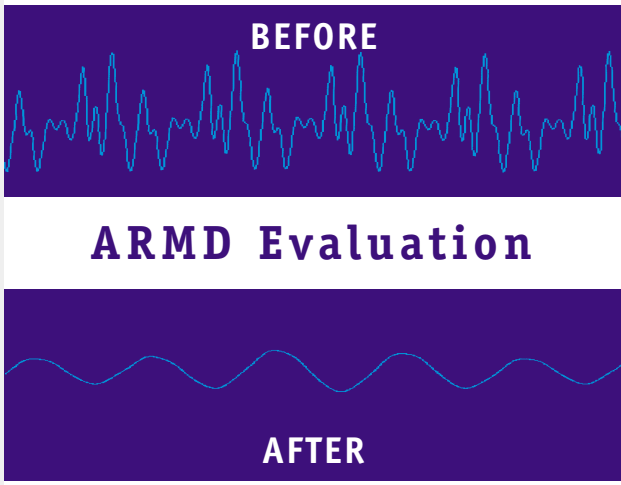


**Computer Disk Drive Spindle Herringbone Configuration Journal Bearing Clearance & Pressure Distribution For Concentric Operation @ 10,000 Rpm.**






**ARMD** for Windows incorporates advanced technical and user interface features with built-in help utilities and templates in each of its modules to simplify modeling, analysis, presentation and interpretation of results. On-line tutorial and step by step sample sessions with advanced graphical presentations are among the many features implemented in the new version.



# Rotor Dynamics (ROTLAT™)

ROTLAT is **finite element** based software for performing damped and undamped critical speeds, mode shapes, stability, unbalance response, and time-transient response. ROTLAT consists of four sub-modules: **ROSTAB**, **ROTORMAP**, **ROSYNC**, and **RORESP** integrated by ROTLAT's module messenger. The messenger controls the sub-modules to provide a complete lateral vibration analysis environment.

ROTLAT's modeling capabilities include solid, hollow, tapered and stepped type elements; cylindrical, conical, tilting-pad, and rolling element type bearings; gravitational loading, bearing elevation, gyroscopic effects, flexible coupling, casing, foundation flexibility, and material damping in the shaft and foundation.

ROTLAT's analytical results include:

**STABILITY ANALYSIS**

- Natural frequencies and mode shapes
- Growth factors/damping ratios
- Rotor orbit directions
- Bearing reaction forces
- Shaft weight, deflection, and centerline slope
- Stability and critical speed maps

**UNBALANCE RESPONSE**

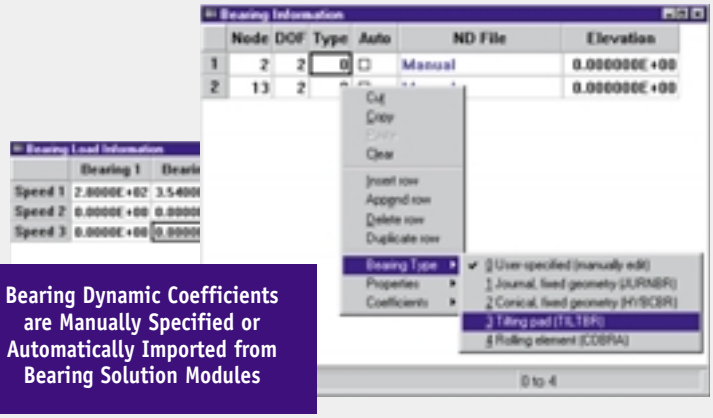
(Synchronous response)

- Multiple unbalance forces
- Magnitude and phase (Bode plot)
- Dynamic forces and moments
- Vibratory amplitudes and orbits
- Forces and moments transmitted to bearings and foundation
- Foundation vibratory amplitudes

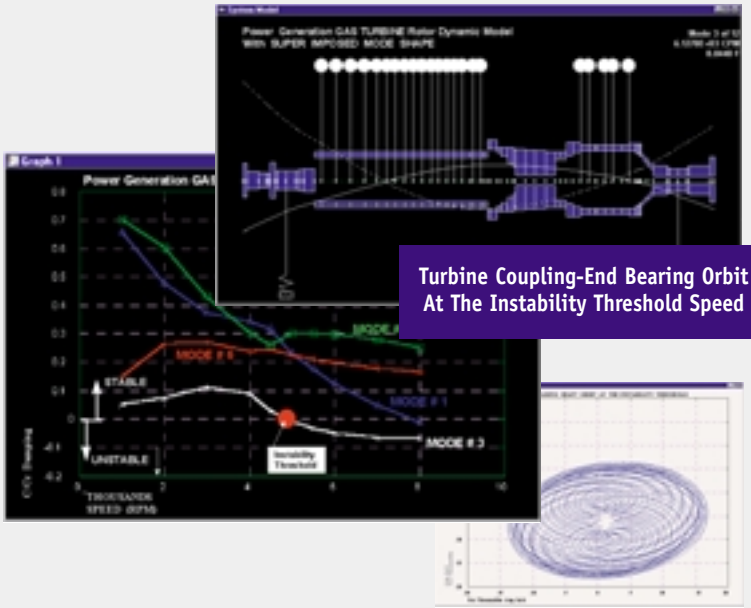
**TIME-TRANSIENT RESPONSE**

(Non-synchronous response)

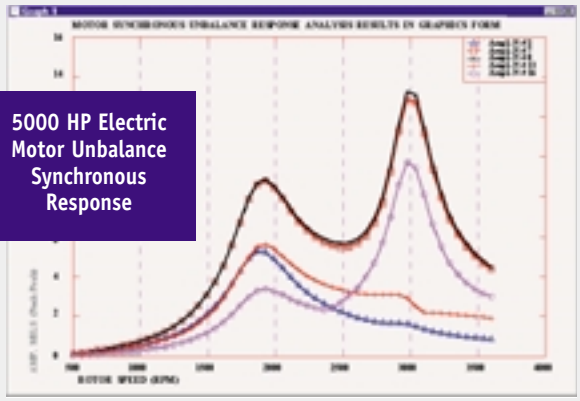
- Gravitational and External force: sinusoidal, step, ramp, & pulse.
- Lateral amplitudes
- Rotor orbits
- Dynamic forces and moments
- Dynamic stresses



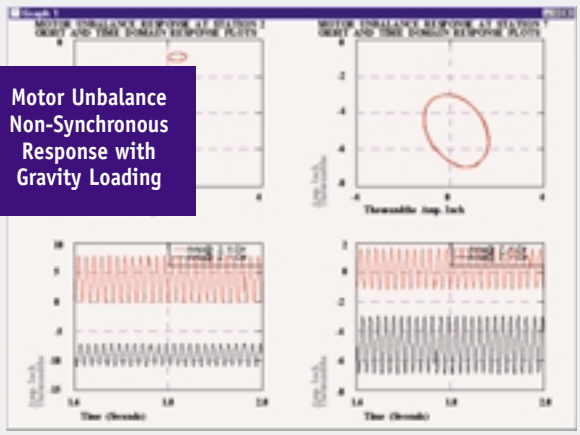

Bearing Dynamic Coefficients are Manually Specified or Automatically Imported from Bearing Solution Modules




Turbine Coupling-End Bearing Orbit At The Instability Threshold Speed



5000 HP Electric Motor Unbalance Synchronous Response



Motor Unbalance Non-Synchronous Response with Gravity Loading

# Torsional Vibration (TORSION™)

The torsional vibration module uses a **finite element** based formulation for performing damped and undamped torsional natural frequencies, mode shapes, steady-state and time-transient response of mechanical drive trains. TORSION consists of three sub-modules **TORNAT, TORHRM** and **TORRSP** integrated by TORSION's module messenger. The messenger controls the sub-modules to provide a complete torsional vibration analysis environment. TORSION accepts models generated with ROTLAT and has the same basic modeling capabilities as well as the modeling of multi-shaft/multi-branch systems, coupling stiffness and damping, gear tooth flexibility, various types of external excitation, synchronous motor start-up torque, compressor torque, etc.

TORSION's analytical results include:

### NATURAL FREQUENCY

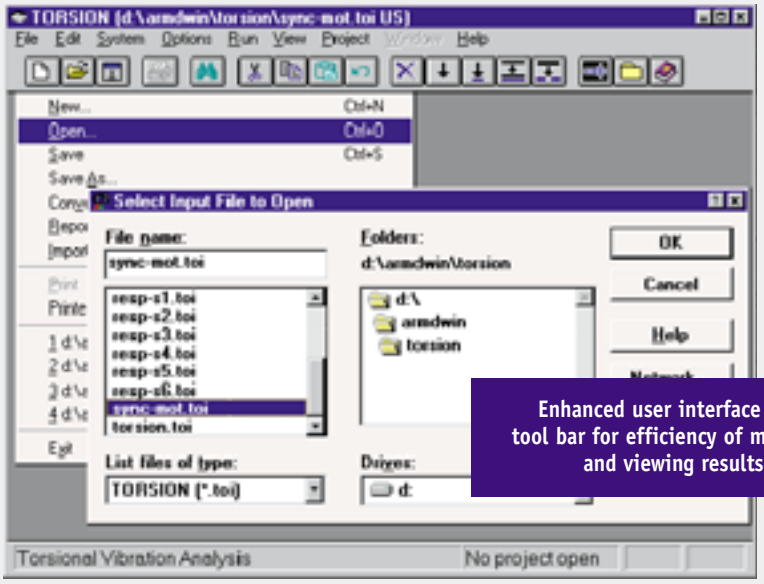
- Damped and undamped
- Growth factors/damping ratios
- Mode shapes of vibration
- Critical speed map (Campbell Diagrams)

### STEADY STATE RESPONSE

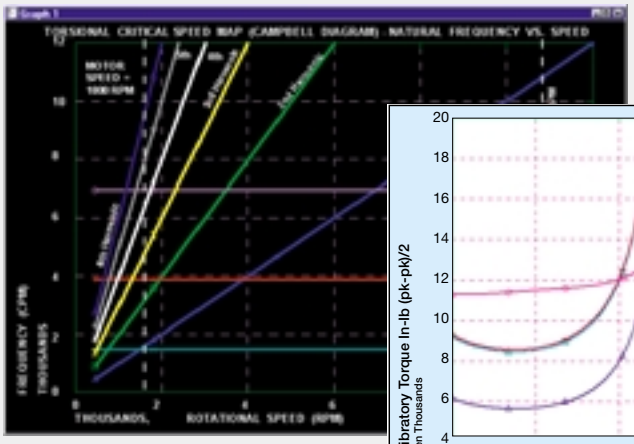
- Vibratory amplitudes (displacement, velocity and acceleration)
- Dynamic torques/stresses
- Dynamic Heat Dissipation

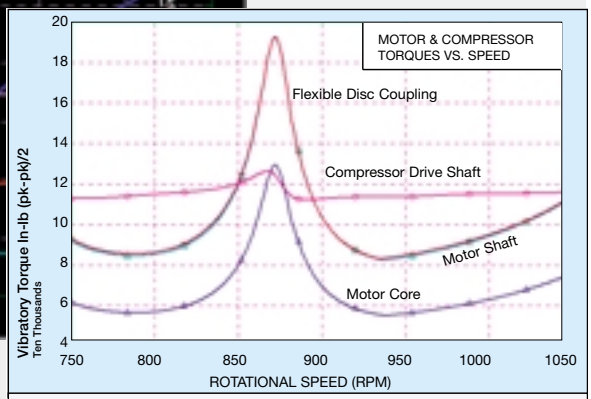
### TIME-TRANSIENT RESPONSE

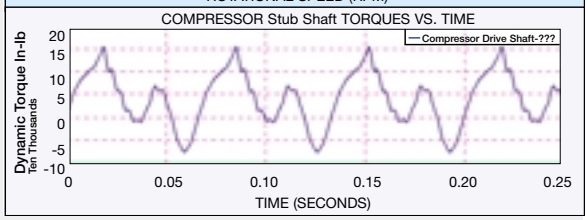
- Dynamic shaft torque time history
- Dynamic stresses
- Fatigue life




Enhanced user interface with tool bar for efficiency of modeling and viewing results

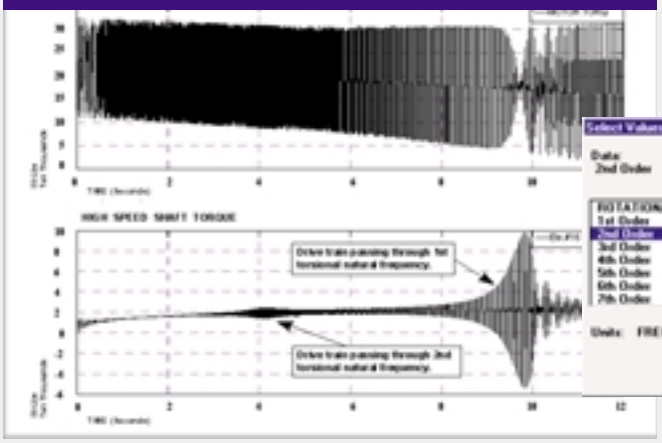


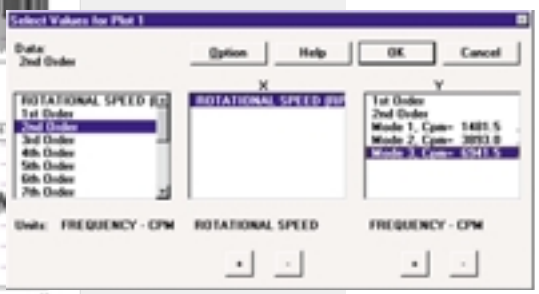




Torsional natural frequencies can be dynamically excited by rotational speed or other sources of excitation such as the pulsating torques in synchronous motor during start-up. TORSION predicts dynamic amplification and performs fatigue analysis for determining system acceptability for its intended application.

Graphics utility permits user defined graph settings, scaling, and many other options.




Graphics screens can be copied to other applications such as word processors and presentation utilities for preparation and presentation of technical reports.

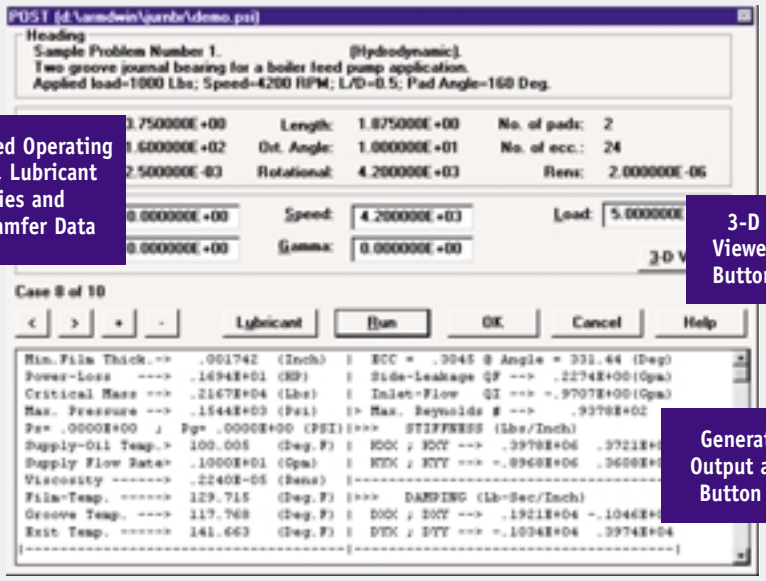
# Bearings

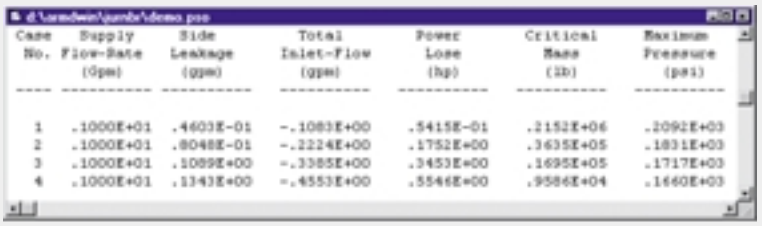
The **ARMD** software package has the capability of evaluating both fluid-film and **rolling-element** bearings. Practically any bearing or bearing system available in the industry can be analyzed with one of the bearing solution modules.

The **FLUID-FILM** bearing modules (**JURNBR**, **HYBCBR**, **TILTBR**, and **THRSBR**) solve the lubrication problem in two dimensions eliminating any approximation typically associated with one dimensional analysis or with look-up table methods. 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 such effects as cavitation, misalignment, pressurized boundaries or grooves, structural deformation, lubricant feed circuitry (JURNBR) with specified pressures or restrictors (capillary, orifice, or flow control valve), groove geometry and chamfers.

Results include:

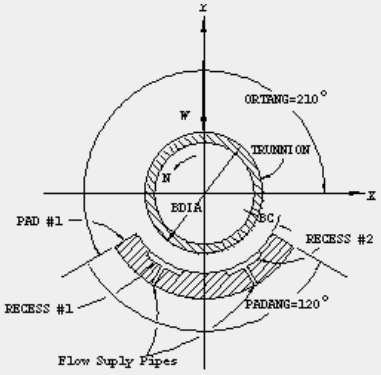
- Load capacity/journal position
- Attitude angle
- Viscous power loss
- Righting moments
- Flow requirements
- Stability (bearing whirl)
- Spring and damping coefficients
- Clearance and pressure distribution
- Recess pressures and flows
- Heat balance and temperature rises

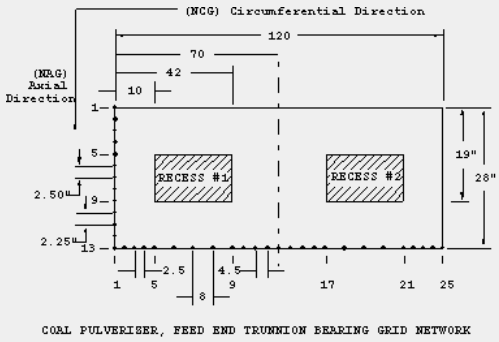


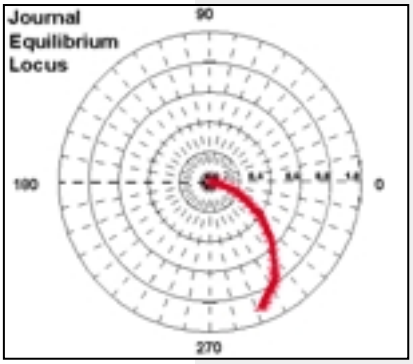



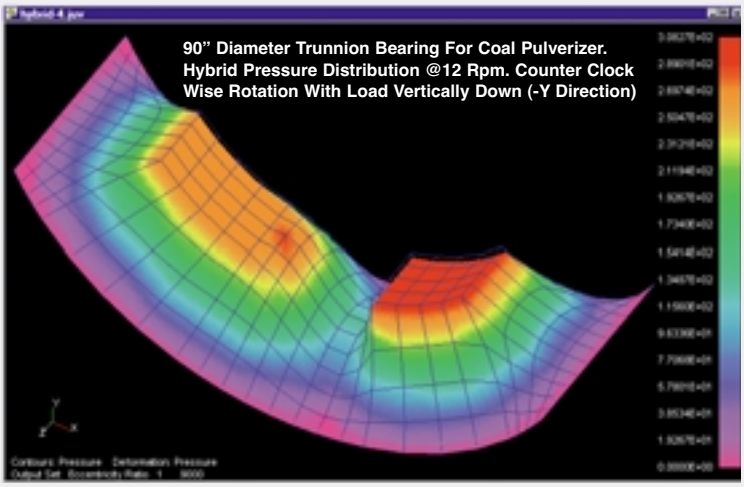
| Case No. | Supply Flow-Rate (Gpm) | Side Leakage (gpm) | Total Inlet-Flow (gpm) | Power Lose (hp) | Critical Mass (lb) | Maximum Pressure (psi) |
|---|---|---|---|---|---|---|
| 1 | .1000E+01 | .4603E-01 | -.1083E+00 | .5415E-01 | .2152E+06 | .2092E+03 |
| 2 | .1000E+01 | .8048E-01 | -.2224E+00 | .1752E+00 | .3635E+05 | .1831E+03 |
| 3 | .1000E+01 | .1089E+00 | -.3385E+00 | .3453E+00 | .1695E+05 | .1717E+03 |
| 4 | .1000E+01 | .1343E+00 | -.4553E+00 | .5546E+00 | .9586E+04 | .1660E+03 |

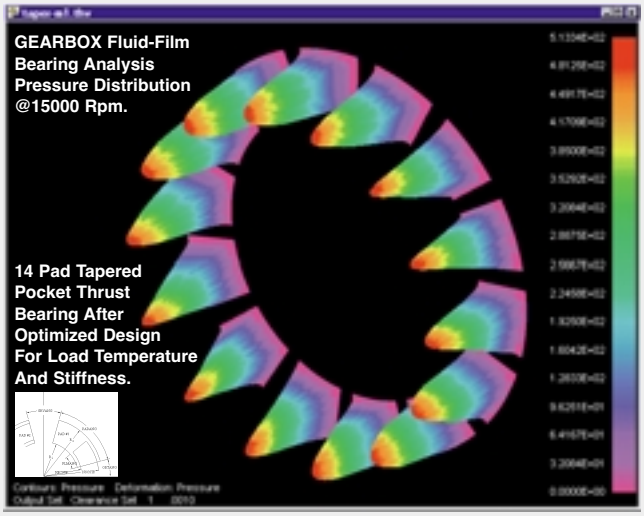
**Simulation of Hydrostatic, Hydrodynamic or Hybrid Lubricated Bearings are a Unique Feature of ARMD Software.**






The **FLUID-FILM** bearing modules incorporate numerous templates for common bearings used in industry. In addition, bearing configurations that can be evaluated with the various solution modules include but not limited to:

**Cylindrical & Conical (JURNBR™ & HYBCBR™)**

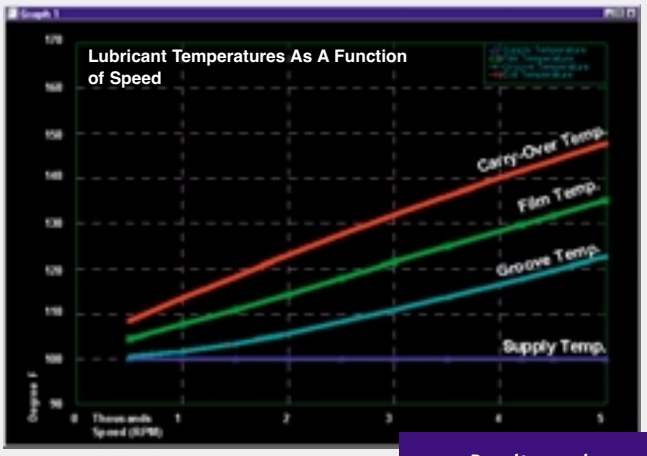
- Plain
- Multi-groove
- Tapered land or pocket
- Rayleigh step or pocket
- Pressure dam
- Elliptical or lemon
- Lobe or canted lobe
- Multi-recess

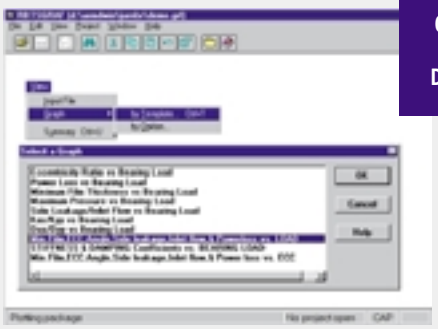
**Thrust-Fixed and Tilting-Pad (THRSBR™)**

- Plain
- Multi-groove
- Tapered land
- Tapered pocket
- Step land
- Step pocket
- Tilting pad
- Compound taper

**Tilting-Pad Geometry (TILTBR™)**

- Tilting pad with user specified:
  - Pivot location
  - Preload



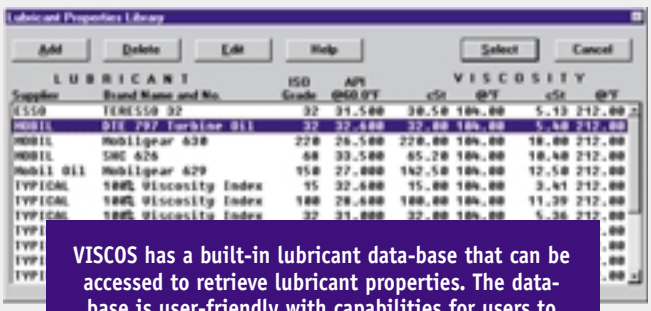



Results can be Graphically Plotted By Template or User Defined Graph Settings

The **ROLLING-ELEMENT** bearing module predicts the performance of up to six bearings of different types mounted on a shaft and experiencing radial, thrust and moment loading. Bearing types include Conrad (radial) ball, angular contact ball, cylindrical roller tapered roller, and spherical roller bearings. The program allows the evaluation of misalignment, offsets, preload, clearance or end-play on bearing performance. Bearing preload from spacer grinding or shimming as well as preload springs is included. Individual bearings can be made to "float".

Bearing performance results include ball load distribution, stress distribution, system and individual bearing reaction loads and displacements, Hertz contact stress, B10 life, contact angles, and spring rate.

The **LUBRICANT** module **VISCOS**™ calculates temperature dependent properties of lubricating fluids. The program requires the user to specify lubricant input or to select it from the built-in lubricant data base. VISCOS generates, as a function of temperature, such parameters as absolute viscosity, kinematic viscosity, Saybolt universal viscosity, specific gravity, weight density, specific heat, heat content, and thermal conductivity.




VISCOS has a built-in lubricant data-base that can be accessed to retrieve lubricant properties. The data-base is user-friendly with capabilities for users to add and delete records as they wish.

## Purchasing Options

**ARMD** is constructed from various solution modules. It can be tailored to suit your needs and budget. You may purchase any combination of programs or all if you wish. With your purchase, the package includes a CD-ROM, user's manual, tutorial and orientation session (optional), updates, maintenance, and support.

## System Requirements:

Microsoft Windows 9x, Me, NT4, 2000, XP or higher operating system, 128 Mbytes Ram.

**Remember,** with **RBTS**, you get more than just the software, you get the company with more than 40 years of experience in the areas of tribology and machinery dynamics.

For further information, please contact us.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Home Page: www.rbts.com
Email: info@rbts.com


# ARMD™

The Worldwide Leading Software For Rotating Machinery Analysis

**A**dvanced
**R**otating
**M**achinery
**D**ynamics

**ARMD** is a well established software package used worldwide to perform complete rotating machinery dynamics analysis. ARMD employs a user-friendly interface and window environment with pull-down menus 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 a gear box for a Uranium enrichment plant.

RBTS's software has gained international reputation for its:

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