XLRotor for Rotordynamics Analysis

Get More Accurate Results, Faster

Is your current rotordynamics analysis software out of date?

Does it require model size reduction, manual intervention, data conversion, and formatting?

Do you have new requirements it cannot satisfy?

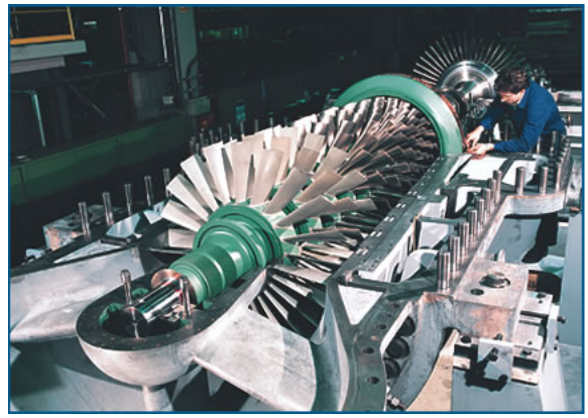
Are you being squeezed by ever-tighter project deadlines and budgets?

With XLRotor you can perform virtually any kind of rotordynamic analysis on rotor bearing system models. XLRotor is ideal for use in the design, maintenance, evaluation and audit of a wide variety of rotating equipment.

The heart of XLRotor is a proprietary computation engine built around advanced mathematical modeling algorithms. XLRotor is so powerful and fast that model size reduction is NOT required, so you get more accurate results, faster, than with other programs on the market.

XLRotor Benefits

- **Easy to learn:** Familiar, modern interface and extensive online help.
- **Time-saving:** Fully automate any or all aspects of program use.
- **Fast, powerful, and accurate**: XLRotor's proprietary algorithms
  - o Eliminate the need for model size reduction
  - o Speed computation
  - o Deliver more accurate results.
- **Customizable and extensible**:
  - o Adjust formulas to calculate any or all model inputs.
  - o Use company-specific formats for both data input and report output.



The XLRotor computation engine integrates with Microsoft Excel to increase versatility, enhance automation capabilities, and reduce valuable time spent building and generating reports. You can use the packaged analysis modules and charts out-of-the-box, or customize them with your own formulas and formats. Once you complete the analysis, you can flow the results, including charts and plots, directly into popular off-the-shelf word-processing and presentation software.

XLRotor comes with online help and an extensive set of sample files that eliminate expensive training and consulting fees and help you get started faster. It also includes bearing and seal analysis modules that can be used independently or embedded within a rotor analysis file.

Rotating Machinery Analysis, Inc.
Rotating Machinery Analysis, Inc. (RMA) was founded in 1994 to provide consulting services and software to the rotating machinery community. In 1995, we began marketing XLRotor, a suite of analysis tools for rotating machinery dynamics. Today, engineers around the world use XLRotor to solve rotordynamics problems every day. RMA is committed to delivering prompt, responsive, and personalized support for any issues or questions.

This data sheet contains a comprehensive list of features and examples. For more information, please contact RMA at the email address below.

Xlrotor Software Features

Analytical-Linear

- Lateral
  - Undamped synchronous critical speeds vs support stiffness
  - Free-free natural frequencies vs speed
  - Compute stability vs speed (damped eigenvalues)
  - Synchronous imbalance response vs speed
  - Asynchronous response to rotating or rectilinear forces vs speed
  - Asynchronous force frequencies can be independent of speed or a multiple of speed
  - Operating deflected shapes at any number of speeds in one operation
  - Static deflections due to weight
  - Static deflections due to arbitrary loads
  - Singular Value Decomposition analysis
- Torsional
  - Damped and undamped eigenvalues and mode shapes
  - Response to harmonics of speed, amplitudes can be functions of speed
  - Operating deflected shapes
  - Easy analysis of reciprocating machinery
  - Time-waveform analysis for reciprocating machinery
- Coupled Lateral-Torsional Analysis

Analytical-Nonlinear

- Transient response to arbitrary time dependent loads
- Supports time, position and velocity dependent nonlinearities
- Provides identical functionality for both lateral and torsional models
- Quasi-nonlinear analysis – where linear analysis is done iteratively to satisfy nonlinear constraints
- You can
  - Conveniently enter simple nonlinearities as worksheet cell formula functions of time, position and velocity at one degree of freedom.
  - Program arbitrarily complex nonlinearities in Excel VBA, Microsoft VB, FORTRAN, C and C++

Modeling

- Cylindrical beam elements – Euler beam flexure and Timoshenko shear
- Conical beam elements, consistent mass
- Commands to make elements automatically
- Commands to sort model in different forms
- General stiffness elements
- RIGID, PINNED and GUIDED constraints
- Unlimited number of elements
- Unlimited number of degrees of freedom
- Unlimited number of rotors – same or different speeds
- Unlimited number of housings
- Unlimited number of bearings
- Material properties distinct for every beam
- You can
  - Define and superpose multiple (stacked) beams

Modeling (continued)

  - Model both rotors and housings
  - Link (relate) any model input to any other model input
  - Enter any model input as a value or as a formula
  - Easily create bearings with minimal input using the Quick Bearings feature
  - Import models from RAPP, RBTS, DyRoBeS and XLTRC2 (New import filters can be easily created either by RMA, Inc. or by end users)
  - Output model geometry (all or part) to Autocad to Solidworks

Interface

- All model inputs are entered on worksheets
- Modeling and analysis options set with tabbed dialog boxes
- Extensive context-sensitive online help
- All program output is placed on worksheets readily accessible for review, printing, customizing, reporting or further analysis
- All chart formats are read from customizable templates
- You can
  - Customize chart format templates at a project level
  - Change order of input columns by dragging with the mouse
  - Change all formatting (font, color, precision, alignment, etc.)
  - Copy and paste all program inputs and outputs to Microsoft Word (or similar) as one time static copies or as auto-updating linked copies.
  - Easily create additional charts from tabulated program output
  - Output computed frequencies in cpm, hz or rad/sec
  - Output computed damping factors as log dec, damping ratio, damping exponent or amplification factor
  - Change frequency and damping units after the analysis is done
  - Compute mode shapes for multiple roots by selecting the roots with your mouse
  - Compute mode shape for roots by selecting them on a natural frequency map or undamped critical speed map
  - Animate mode shapes on 2d charts, 3d charts, and as full deformation plots of entire model geometry
  - Animate one or more mode shapes simultaneously
  - Use either diameter or radius for input
  - Work in customary English units (in-lbf-sec), strict SI units (m-N-sec) or modified SI units (mm-N-sec)

Charts and Plots

- Charts of results are created automatically
  - Model geometry cross section
  - Undamped critical speed map vs support stiffness
  - Undamped free-free natural frequencies vs speed
  - Damped natural frequencies vs speed (cpm, hz or rad/s)
  - Damping factor vs speed (log dec, damping ratio or damping exponent, AF)
  - Root locus plot (damping factor vs natural frequency)
  - 2D mode shapes
  - 3D mode shapes
  - Torsional interference diagram (Campbell)
  - Bode plots of displacement response with or without phase (also Polar plots)
  - Operating deflected shapes plots
  - Transient time history plots of position, velocity and acceleration
  - Transient bearing reaction load plots vs time
  - Transient nonlinear element load
  - Transient applied time dependent load
  - Transient beam element internal element reaction loads vs time
- Other special charting features
  - Animate any mode shape chart
  - Make animation files, use in Powerpoint
  - Display synchronous excitation line on natural frequency maps
  - Display bearing stiffnesses on undamped critical speed maps
  - Label response peaks with Amplification Factor and critical speed margin
  - Convert Bode plots to polar plots and orbit plots, and vice versa
  - Overlay model geometry on mode shapes and operating deflected shapes
  - Convert time history plots to FFT spectrum plots, and vice versa

Automation

- XLRotor includes customizable worksheets and VBA macros that perform many API Analysis tasks in one operation
- XLRotor can be
  - Fully operated by Visual Basic macros
  - Run from Microsoft Office applications including Excel, Word and Powerpoint
  - Run from stand alone Visual Basic or C programs
- Includes numerous working examples
- You can
  - Automate report generation
  - Create or change all program inputs
  - Modify all program option settings
  - Execute all analysis commands
  - Fully automate routine analysis tasks like varying bearing clearances and imbalance distributions
  - Perform complex analyses with user-defined loops and iteration control – examples are included
  - Use special features to suppress normal user prompts when being run from macros

Customization

- You can
  - Add commands to the Xlrotor menu to run your own Visual Basic macros
  - Add or delete buttons from the Xlrotor toolbar
  - Create company and project specific templates for rotor model creation
  - Customize formatting of any program input – fonts, color, alignment, precision, numerical format, etc. – then save in your template
  - Generate all XLRotor charts from one chart template file – xlrgrph.xls (Allows multiple copies of xlrgrph.xls – program first looks in directory of your model file, then the Xlrotor home directory)
  - Customize any formatting property of any chart in xlrgrph.xls
  - Add custom content, like logos and project numbers, to the chart templates
  - Integrate your own bearing & seal analysis codes into Xlrotor and Microsoft Excel from any program written in FORTRAN, C or Visual Basic.

Bearings

- Includes comprehensive set of bearing and seal analysis modules
  - Oil film bearings
    - Plain sleeve
    - Multi-lobe sleeve and lemon bore
    - Partial arc
    - Pressure dam
    - Tilting pad
  - Ball bearings
  - Cylindrical roller bearings
  - Active Magnetic Bearings
    - Transfer function input
      - Polynomials
      - Poles & zeros
      - Gain/phase curve fitting
      - State space form
      - Import from Matlab
    - SISO and MIMO analysis
  - Pocketed hydrostatic bearings
  - Incompressible annular pump seals
  - Labyrinth, honeycomb and hole pattern seals
  - Oil lubricated squeeze film dampers with and without end seals
  - Centrifugal compressor impeller aerodynamic cross coupling
  - Axial flow stage cross coupling (Alford's force model)
  - User defined bearings (stiffness, damping & mass with each up to 4x4 matrix)
- Model and analyze individual bearings with type-specific worksheet templates
- Templates provide both English and SI units
- Save bearing worksheets within a rotor model file or as a separate file
- Use one bearing sheet in multiple places
- Reference inputs to a bearing worksheet directly from a rotor model (e.g. shaft diameter and axial length)
- Use mixed units (e.g. rotor in English units, bearings in SI, or vice versa)
- Optional XLHydrodyn module for comprehensive design of oil film bearings

Example Files

XLRotor is supplied with 120+ example files that solve classic and common analysis problems. Some files demonstrate using macros to automate tasks. Use these files to get started quickly, and then customize them as your engineering needs dictate. New examples are added periodically. This page lists most examples included at time of production of this data sheet.

Lateral Examples

2 Level Rotor.xls
2 line rotor illustrating rigid and pinned connections.xls
2-DISK Rotor Example.xls
2-DISK rotor with flexible housing.xls
2-DISK with Command Macro.xls
2-DISK with Pedestals.xls
2-DISK with SFDs and API sheet.xls
2-DISK with SFDs.xls
API compressor analysis.xls
Axial tension validation case, hanging chain.xls
Axial tension validation case, pinned uniform beam.xls
Childs sample rotor, page 125.xls
Generator with Bearing Housings.xls
Generator with Support DOF.xls
Genta gas turbine rotor, page 339.xls
Genta rigid gyroscopic rotor, page 319.xls
Glasgow and Nelson, Stability analysis using component mode synth, 1979, case4.xls
Glasgow and Nelson, Stability analysis using component mode synth, 1979, two spool rotor.xls
Lalanne, 1990, dual rotor, Figure 22.xls
Lalanne, 1990, dual rotor, Figure 23, method 1.xls
Lalanne, 1990, dual rotor, Figure 23, method 2.xls
Lalanne, 1990, dual rotor, run with macro.xls
Lund and Tonnesen, Experiments on Multi-Plane Balancing, 1972.xls
Lund, Sensitivity of critical speeds to design changes, 1979.xls
Lund, Stability paper, 1974, figure 1.xls
Lund, Stability paper, 1974, figure 3.xls
Macro Example of Copying to Word.xls
Multi-stage pump, seals.xls
Multi-stage pump.xls
Nelson and McVaugh, 1976 case a.xls
Nelson and McVaugh, 1976 case b.xls
Nonlinear Spring Iteration with a Macro.xls
Prohl, General Method for Critical Speeds, 1945.xls
Salamone and Gunter, Shaft warp and disk skew, 1978.xls
Schweitzer-Maslen AMB Flexible Rotor Example-16.xls
Schweitzer-Maslen AMB Flexible Rotor Example-56.xls
Short stubby beam in book by Vance.xls
skew overhung disk.xls
Static Deflection due to Gravity.xls
Static Deflection with a Misaligned Bearing.xls
Stephenson and Rouch, Foundation Structure, 1992 Maneuver.xls
Stephenson and Rouch, Foundation Structure, 1992.xls
Tonnesen and Lund, Some Experiments on Instability, 1977.xls
Trunnion Example.xls
Turbine Example.xls
Turbine SI Units Example.xls
Turbo Show Tutorial on AMB Example.xls
uniform beam, Emory and Zhu.xls
Vertical Turbine Pump Example.xls
Multi-stage horizontal pump.xls

Singular Value Analysis

SVD Compressor LBP example.xls
SVD Generator example.xls
SVD paper, 3 mass rotor example.xls
SVD paper, balancing data analysis.xls
SVD paper, point mass example #1 SI units.xls
SVD Three Mass Lab Rotor, 8 ways.xls
Multi-stage horizontal pump.xls

Transient Examples

2 mass example from Piche.xls
transient 2-DISK blade loss.xls
transient 2-DISK earthquake, accel.xls
transient 2-DISK earthquake, disp.xls
transient 2-DISK xljrnl.xls
transient Bathe example pg 510.xls
transient Childs & Moes paper, case 1.xls
transient Childs & Moes paper, case 2.xls
transient Childs page 175, fig 3.21.xls
transient Childs page 176, fig 3.22.xls
transient Childs page 176, fig 3.23.xls
transient Childs page 177, fig 3.24.xls
transient Childs, Simulation Model for Flexible, 1972.xls
transient Hughes example pg 538, lateral.xls
transient Hughes example pg 538.xls
transient Hughes example pg 542.xls
transient Jeffcot with deadband.xls
transient Jeffcot with speed ramp.xls
transient Nelson and Meacham, rotor 1.xls
transient Shiau and Jean, Nonlinear Transient analysis of large systems, 1991 .xls
transient Tonnesen and Lund, 1977 a.xls
transient Tonnesen and Lund, 1977 b.xls
transient Tonnesen and Lund, 1977 c.xls
transient turbocharger, with floating ring bearings.xls
transient uniform beam.xls
transient Wave Propagation Along Beam.xls
transient Xltorsion Lalanne example pg 211.xls
transient Xltorsion, draft fan with motor short circuit.xls
transient Yamamoto, pg 160, speed ramp through critical.xls
XLTorsion 3 Mass Transient Example, Vance pg 77.xls

Torsional Examples

XLTorsion Example screw compressor.xls
XLTorsion Example, 3 inertia.xls
XLTorsion Example, BICERA pg 179.xls
XLTorsion Example, BICERA pg 179a.xls
XLTorsion Example, Ehrich 1.xls
XLTorsion Example, Ehrich 2.xls
XLTorsion Example, Ehrich 2a.xls
XLTorsion Example, Harris, Fig 38.10.xls
XLTorsion Example, MacDuff pg 313.xls
XLTorsion Example, proportional damping.xls
XLTorsion Example, pump-gbox-motor.xls
XLTorsion Example, Rao pg 14.xls
XLTorsion Example, Rao pg 23.xls
XLTorsion Example, Steidel 9.14 and 9.16, stress calc.xls

XLTorsion Example, Steidel 9.4 and 9.26.xls
XLTorsion Example, uniform shaft.xls
XLTorsion Example, Wachel & Szenasi, Fig 1.xls
XLTorsion Example, Wachel & Szenasi, Fig 31.xls
XLTorsion Example, Wachel & Szenasi, Fig 39.xls
XLTorsion Example, Wilson, Example 14.1.xls
XLTorsion Example, Wilson, Example 14.2.xls
XLTorsion Example, Wilson, Example 14.4.xls
XLTorsion Example, Wilson, Fig 14.1.xls
XLTorsion Example, Wilson, Fig 14.2.xls

Coupled Examples
XLCoupled 3 Stage IGC.xls
XLCoupled Choi sample rotor, Fig 6 & Fig 7.xls
XLCoupled Choi sample rotor, Table 2 & Fig 5.xls
XLCoupled Friswell page 458.xls
XLCoupled GT-Gearbox-Generator.xls
XLCoupled Turbo-Chiller.xls

System Requirements
IBM-compatible PC or laptop; 512MB RAM recommended. XLRotor works with all Windows 32 bit and 64 bit versions up to Windows 10. XLRotor runs as either a 32 bit or 64 bit application, depending on your version of Excel, and is compatible with all 32-bit and 64 bit versions of Excel, starting with Excel 97 (Excel version 8.0).

XLRotor requires approximately 250MB of free space on the hard disk for installation.