

Improvements for Ver 20.10

February 16, 2018

- Add Analysis Type 13 Morton Effect
- Add Analysis Type 14 Multiple Analyses for the same rotor file
- Enhance PostProcessor Graphics in the Time Transient Analysis Frequency Domain

In this release note, we will present some examples to illustrate the use of these new features. The first example is shown below. Although this expander example is mainly used to demonstrate the Morton effect, it is also used to demonstrate other features.



In this example, the bearing data is read from the file created by using BePerf, i.e., bearing type 15 - Link the BePerf data file. Note that this bearing type is for the linear analysis only. The program will automate the bearing linearization process internally and prepare the linearized coefficients to be used in the rotordynamic analysis. Four bearing files, or four bearing types, can used in this option:

- *.LDI Fixed Lobe Bearings
- *.TDI Tilting Pad Bearings
- *.FRB Floating Ring Bearings
- *.GDI Gas Bearings

Rotor Bearing System Data
Axial Forces Static Loads Constraints Misalignments Shaft Bow Time Forcing Harmonics Torsional/Axial Units/Description Material Shaft Elements Disks Unbalance Bearings Supports Foundation User's Elements
Bearing: 1 of 2 Foundation Add Brg Del Brg Previous Next
Station I: 8 J: 0
Type: 15- Link BePerf Data File (".LDI, ".TDI, ".FRB, ".GDI) Linear Analysis 💽
Comment: Compressor 127.7 lb load LOP
FileName: Morton_Example1_Brg1.TDI Browse
Unit(2) - Kt: Lbf/in, Ct: Lbf-s/in
Save Save As Close Help

Rotor Bearing System Data	
Axial Forces Static Loads Constraints Misalignments Units/Description Material Shaft Elements Disks Unba	Shaft Bow Time Forcing Harmonics Torsional/Axial alance Bearings Supports Foundation User's Elements
Bearing: 2 of 2	Add Brg Del Brg Previous Next
Station I: 13 J: 0	
Type: 15- Link BePerf Data File (*LDI, *.TDI, *.FRB, *.GDI) Li	Linear Analysis
Comment: Turbine 127.7 lb load LUP	
FileName: Morton_Example1_Brg2.TDI	Browse
	Unit.(2) - Kt: Lbf/in, Ct: Lbf-s/in
	Save Save As Close Help

DyRoBeS_BePerf C:\DyRoBeS2010\E	xampleWorton_Example1_Brg1.TDI
Project Fixed-Lobe Tilting-Pad CompareDesig	n Floating-Ring Gas-Brg Thrust-Brg Lubricant-Flow Hydrostatic Tools View Help
	Compressor 127.7 Ib load LOP
	Tilt Pad Bearing - Dimensional Analysis 🗙
Bearing Data	Comment: Compressor 127.7 lb load LOP
L = 1.89 in D = 3.73 in	Coordinates: Standard Coordinates (X-Y) 💌 Load Angle: 270 degree
Cb = 0.0039 in	Analysis Option: Heat Balance 🗨 K and C Coordinate Angle: 0 degree
2Cb/D = 0.0021 Pivot Angle = 54	Convert Units: English Bearing Load = W0 + W1 x RPM + W2 x RPM^2 (Lbf)
Preload = 0.3	Length L: 1.89 (inch) W0: 127.7 W1: 0 W2: 0
Arc Length = 60	Diameter D: 3.73 (inch) Rotor Speeds (RPM) Additional Speeds
Load On Pivot	Brg Radial Clr Cb: 0.0039 (inch) Start: 1000 End: 15000 Inc: 1000
Qsup = 1.5 gpm	Bearing Preload: 0.3 Advanced Lubricant: Amokon ISO-VG 46
Q factor = 0.3 Neglect Pivot Effect	Number of Pads: 5 No Inlet Temperature: 120 (deg.F)
\	Pad Arc Length: 60 degree Heat carried away: 80 (%)
	Pad Pivot Offset: 0.5 Supplied Flow: 1.5 (GPM)
	Load Vector Load On Piret
	Click here for Pad/Pivot Data Pivot Type: Neglect Pad/Pivot Effect
	New Open Save Save As Run Parametric Close
For Help, press F1	NUM
Project Fixed-Lobe Tilting-Pad CompareDesign	cample Worton_txample1_Brg2.101 Floating-Ring Gas-Brg Thrust-Brg Lubricant-Flow Hydrostatic Tools View Help
	Turbine 131 7 lb load LOP
	Till Dad Bearing - Dimensional Analysis
De aview Data	
L = 1.89 in	Commence fullione (51.7) to load Con-
D = 3.73 in Cb = 0.0039 in	Analysis Option: Heat Balance
2Cb/D = 0.0021 Pivot Apple = 54	Convert Units: English Bearing Load = W0 + W1 × RPM + W2 × RPM^2 (Lbf)
Preload = 0.3	Length L: 1.89 (inch) W0: 131.7 W1: 0 W2: 0
Offset = 0.5 Arc Length = 60	Diameter D: 3.73 (inch) Rotor Speeds (RDM) C Additional Speeds
Load On Pivot	Brin Bartial Cir Chr (0.0039) (inch) Start: 1000 End: 15000 Inc: 1000
Qsup = 1.5 gpm	Parting Protect 0.3 Advanced Lubricant America 1907/9.46
Q factor = 0.3 Neglect Pivot Effect	Number of Dady 5 No Inter Transferrer 120 (dec E)
	Red Ara Levels (C) degree Heat carried away: (80 (20)
	Supplied Flow: 15 (GPM)
	Pad Pivot Offset: 0.5 Supplied How 1.5 (all m)
	Pad Pivot Offset: [0.5 Supplied How [1.5 (all M)] Load Vector: Load On Pivot 0.3 Q Integration Factor
	Pad Pivot Offset: 0.5 Supplied How: 1.3 (all M) Load Vector: Load On Pivot Image: Click here for Pad/Pivot Data 0.3 Q Integration Factor
	Pad Pivot Offset: 0.5 Supplied How. 1.3 (all M) Load Vector: Load On Pivot 0.3 Q Integration Factor Click here for Pad/Pivot Data Pivot Type: Neglect Pad/Pivot Effect New Open Save Save As Run Parametric Close

Again, these two files were created using BePerf:

It is strongly recommended that you analyze the bearing using BePerf first to ensure the bearing performance, such as minimum film thickness, maximum temperature, etc., meet the design criteria before performing any rotordynamics analysis.

To demonstrate the multiple analysis option, go to Analysis – Lateral Vibration – Analysis type 14 as shown below. Check the analysis you would like to analyze and Click OK. Then Click Run.

Lateral Analysis Option & Run Time Data 🛛 🛛 🗙						
Analysis: 14- Multiple Analyses		Ŧ	Transient Analysis	Gravi	ty (g)	
Shaft Element Effects		Multiple	Analyses	X		
🔽 Rotatory Inertia 🔽 Shear Deformation 🔽 Gyroscopic						
Static Deflection	Critical Speed Map-	I 1-	Static Deflection & Bearing Loads	OK	85.088	
🔽 Constrained Bearing Stations	Spin/Whirl Ratio: 1	□ 2·	Critical Speed Analysis	Canad		
Critical Speed Analysis	Bearing K - Min: 100	💌 3-	Critical Speed Map		ie zero Gz	
Spin/Whirl Ratio: 1	Npts: 50 Max: 1e+	4	Whirl Speed & Stability Analysis		ical Rotor	
No. of Modes: 5	Stiffness to be varied	I 5	Steady State Synchronous Response - Linear Syst	tem	· · · ·	
Brg Stiffness: Kxx 💌	Bearings: All	F 6-	Steady Synchronous Response - Non-Linear Syste	em	lesign nparison	
@ rpm: 0	, Allow Bearing:	□ 7·	Time Transient Analysis - Time Domain			
Whirl Speed and Stability Analysis	- Steady State Synchroi	E 8-	Steady State Harmonic Excitation Response			
RPM-Starting: 0	RPM-Starting: 1000	F 9-	Steady Maneuver Load Analysis			
Ending: 0	Ending: 1500	l 10) - Time Transient Analysis - Frequency Domain		Run	
Increment: 0	Increment: 500	E 11	- Natual Catenary (Gravity Sag) Analysis			
No. of Modes: 4	Excitation Shaft: 1	🗖 12	- Whirl Speed & Stability with Aerodynamic Cross-C	Coupling		
Aerodynamics - Q	💌 All Synchronized				lancel	
Steady Maneuvers (Base Constant Translational Acceleration and/or Turn Rate)						
Speed (RPM): 0 Acceleration - X: 0 Y: 0 Ref Pos: 0						
L						

Once the analysis is done, you may use the postprocessor to view the analysis results as if they were analyzed individually. Note that if you use Bearing type 15, there are several intermediate files created with "_design.*" after the bearing file name. *.brg are the linearized bearing coefficients used in the rotordyminic analysis, others are associated output files, which can be used for verification purposes.

To demonstrate the Morton Analysis – Analysis Type 13, go to Analysis – Lateral Vibration – Analysis type 13 as shown below. For more details on the Morton Analysis, please see User Manual Morton Analysis Program by Dr. R. G. Kirk. Several notes are summarized below:

1. Currently, only Tilting Pad Bearing (*.TDI) is considered.

2. Morton Effect was observed for overhung rotors, so when selecting a bearing under study, either LEFT or RIGHT overhang must also be specified.

3. Since Motor Analysis study the thermal growth in the shaft, the Hear Balance must be specified in the bearing file (*.TDI).

Lateral A	nalysis Option & Run Time Data					
Analysis	Transient Analysis	Gravity (g)				
Shaft E	Morton Effect Additional Input Parameters					
🔽 Ro		[
Static [Bearing and Uverhang Parameters	<u> </u>				
Cor	Bearing No.: 1 @ Station: 8 Overhang: Lett	<u>C</u> ancel				
	Bearing Pad Thickness: U.625 (in) Additional Overhang Mass: 0 [Lb]					
Spin/W	File: Morton_Example1_Brg1.TDI					
No.	Lubricant Parameters					
Brg Stift	iff Supply Pressure: 30 (psi)					
@	Ambient Temperature: 70 (degF)					
_ Whirl Sp	Inlet Temperature = 120 degF · Lubricant: Amokon ISO-VG 46					
RPM	Rotor Parameters					
	Design Speed (N): 9864 (RPM)					
In	Journal Coeff. of Thermal Expansion: 6.67e-006 (/degF)					
No. c	Mechanical Overhang Unbalance (UNBM): 1 - 56347xW/N^2 0.150191 (oz·in)					
	Shaft 1 Weight 259 3/61 h. Overhand station: from 1 to 8					
Steady						
Speed (Speed (RPM) Range of Interest					
	Start: 1000 End: 15000 Increment: 1000					
lp, press F1						

To view the results – PostProcessor – Morton Effect. Again, for more information, please see the User's Manual.

