

ADORE Update Version 5.70

Release Date: October 30, 2012

ADORE 5.70 is an enhancement to earlier version 5.60. All temporary fixes issued in versions 5.61 are now permanent in version 5.70. The following is a description of specific enhancements and error fixes:

Code Enhancements

Fatigue Life Modeling

The commonly used Lundberg-Palmgren life model was originally formulated in 1940s. The life constants used in the formula are based on the materials available at the time. Over the years both the material composition and manufacturing techniques for rolling element materials have significantly advanced and the observed bearing lives are much higher than those predicted by the Lundberg-Palmgren model. Thus in ADORE version 5.70 the life computation module is completely rewritten. While the original life formulae are preserved for comparison purposes, a new generalized Lundberg-Palmgren relation has been implemented to permit the user to arbitrarily vary all model constants to better fit the life prediction for current materials. The default life constants are computed by correlating the model to published experimental data on a high speed turbine engine type ball bearing. In addition, life models due to Zaretsky and Ioannides & Harris have been incorporated. This permits a comparison of predicted life by the various models, while the flexibility in varying the model constants permits continued update of the models by correlating the life predictions with experimental data. Thus the models may be continually updated as newer experimental data becomes available. The enhancement results change in both the input data and the print output.

This implementation is a result of an internal research and development project carried out over the last year. The detailed analytical formulation, correlations with experimental data, and comparison of the models for a typical ball and roller bearing has been documented in a technical paper, which has been submitted to Society of Tribology and Lubrication Engineers (STLE) for presentation at the next STLE Annual Meeting in May 2013, and for publication in the STLE Tribology Transactions. A draft copy of this paper is included with this update documentation on the code distribution disk.

Thermal Reduction Factors

This enhancement is related to computation of thermal reduction factor for the elastohydrodynamic lubricant film thickness under very high-speed, heavily loaded rolling contacts. In earlier versions of ADORE an empirical formula, based on analytical solutions, was used to compute the thermal reduction factor under any given set of operating conditions. Under very high speed and heavily loaded conditions, this procedure sometimes yields a negative thermal reduction factor, which is obviously not possible. The problem is solved by setting a lower limit on the thermal reduction factor. Thus when the computed factor is below this limit the value is set to the limiting value. This limiting value is currently set to 0.010. This enhancement is actually transparent to most rolling bearing operating conditions.

ADORE User Manual

ADORE user manual has been appropriately modified to include documentation for new variables related to fatigue life modeling. The new version of the manual is included in the code distribution disk.

ADORE Input, Plot and Animation Facilities

As discussed above, some of the code enhancements have resulted in new input data. Thus the old input data sets will no longer be compatible with this new version. However, the old input data files may be opened with the new version of the input facility, `AdrInput`, distributed with ADORE 5.70, and appropriate modifications to the data can be easily made. The affected data records are 8.6.0, 8.6.1 and 8.6.2. When opening the old data files considerable care must be exercised in examining the data on these records.

There are no modifications to the plot (`adrPlot`) and animation facilities (`agore`).

ADORE Print Output

Modifications to ADORE print output includes new output for the various life models under the “Applied Parameters” section.

Test Cases

As usual the input data, print output and all plot data sets are included in these subdirectories in the program media. These examples must be run and checked after installation of the program. All outputs, at least at step 0, must match against the supplied output.

Since the empirical factors used earlier in the original Lundberg-Palmgren life equation are now removed the computed life with these formulae may be slightly different when compared with earlier ADORE versions. Also while comparing the results with those produced by earlier versions some differences in the transient solutions and time step sizes may be observed. These difference are primarily due to code corrections and enhancements outlined above.

Program File Contents:

As usual program updates are distributed on a CD in normal data format. The files may be easily extracted from this disk on any computer system and then transferred to appropriate system for which ADORE is licensed for.

The media contains the following three subdirectories:

Disk1

Update570.pdf:

A pdf file containing notes of the latest updates (this file).

adoreInput.txt:

A text file containing details of ADORE input data.

adoreManual.pdf:

ADORE user's manual containing detailed instructions for program installation and use.

FatigueLifeModels.pdf:

A draft copy of the paper submitted to STLE for presentation and publication.

Ball:

Subdirectory containing ball bearing test case

Roller:

Subdirectory containing roller bearing test case

TaperedRoller:

Subdirectory containing tapered roller bearing test case

AdrxExamples

Subdirectory containing few of the user program able examples via subroutine ADRX1.

Disk2***.f files:**

ADORE FORTRAN-90/95 source files

Disk3**setup.bat:**

Setup batch file to compile adrInput, adrPlot and AGORE on Windows system.

adrInput.bat:

Batch file to execute adrInput.

adrPlot.bat:

Batch file to execute adrPlot.

agore.bat:

Batch file to execute the graphics animation facility, AGORE.

Java:

Subdirectory containing all Java source.

Program Installation

On the Windows system, if the Microsoft Developer Studio is used to create the executable, the following suggested procedure may be helpful.

1. Start Microsoft Developer Studio and select the File option to create a new project.
2. For type of application, select "Console Application" and name the application as adore560 or other desired name.
3. Once the project space is created, use the insert option to add source files. After navigating to the appropriate source directory, first add the file m_parameters.f only. In the second step add all the m_*.f module files. In the final step all the other source file. The file

to be added is simply selected by a mouse click on the file in the selection widow.

4. Now use the Build option to create the executable.

Java facilities adrInput, adrPlot and Agore

Edit the setup.bat file in Disk3 subdirectory to correct the paths to all source files and the Java Development Kit. Execute the updated setup file to compile and install these facilities.

The setup files for the three applications may then be edited to update the paths and installed in appropriate directory compatible with the environmental variables which provide access to all executables.

Contact Information

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