ADORE Update Version 7.10

Release Date: August 31, 2017

ADORE 7.10 is part of continued enhancement of life models in ADORE. Several new features have been incorporated. In addition, a few minor corrections to the code, identified after release of version 7.00 have been implemented in the updated version. The following is a description of all updates:

1. Code Corrections

1. Minor updates to geometrical setup and related code corrections in initial computations for single row spherical roller bearing have been implemented. These corrections were related to single row spherical roller bearing with arbitrary inclined inner race surface so that a thrust load with proper geometrical constraints may be correctly modeled.
2. In version 7.00 subroutine Adra1 called Adra7 with a argument list when Adra7 collects all required input data from shared data modules. This resulted in a warning message with some compilers. This error has been corrected in current version.
3. Temperature conversion error in subroutine Adraf3 has been corrected. This affects churning and drag computations when using English units.
4. The print statement associated with printing of viscosity coefficients in the input data has been updated to print all input coefficients correctly.
5. The order of arguments in a call to one of the thermal interaction routines, Adrh3, in the calling routine Adrh1 has been corrected.
6. An arbitrary limit on minimum wear rate is set as 1.0E-32 to avoid underflow situation while processing output file SOL7 in the plot facility, AdrPlot.
7. When using the option for arbitrary traction model, with kTrac=9, some lubricant properties were not set correctly in Adrd7. This problem has been corrected.
8. Corrected error in step size used for time-averaging certain performance parameters, when using substeps.
9. A units conversion error in Adrd7 related to the effective viscosity pressure coefficient when using English units has been corrected.

2. Code Enhancements

As a part of continued enhancement of life modeling procedures, this update adds several enhanced features in the life modeling routine:

2.1 More Generalized Stress Capacity Constants

In version 7.00 part of the stressed volume constants were included in the stress capacity constants. These constants are now taken out of the stress capacity constant and added to other constant term, which includes the subsurface shear to contact pressure ratio and the shear stress depth to contact half width ratio. This resulted in a slight modification of the default stress capacity constant

although the computed life is unchanged.

2.2 Residual and Hoop Stresses

Since the maximum orthogonal shear stress used in the LP model is unaffected by the imposed residual and hoop stresses, modification of the failure stress due to these stresses is implemented only in the GZ model, which is based on maximum shear stress. Thus, the computed basic life in the GZ model now includes effect of residual and hoop stresses. The applicable residual stresses are defined in new inputs on input record #9. This enhancement is particularly useful for case hardened materials such as M50-NiL and PyroWear 675. Parametric runs showing the effect of residual stress shall be soon published.

2.3 Ioannides-Harris (IH) Fatigue Limit based Life Model

The IH model in ADORE in practically rewritten to implement a stress limit modifier, which modifies the default stress limit as proposed by Ioannides and Harris. In the new implementation first the maximum orthogonal stress in an equivalent LP model is replaced by maximum octahedral stress determined from the von-Mises stress of the applicable material, as proposed by Ioannides and Harris. Secondly, a stress limit modifier is introduced to further modify the limiting stress. When this modifier is set to zero, the model converges to the LP model with orthogonal shear stress replaced by octahedral shear stress. The default value of 1 sets the stress limit equal to maximum octahedral stress defined by the von-Mises stress. Also, a value 1.28 sets the fatigue limiting stress equal to that derived from 1.50 GPa rolling element to race contact stress, as proposed in the ISO 281 standard. Thus life computations conforming to ISO 281 standard may now be obtained with the IH model with stress limit modifier set to 1.28. Since the IH model implementation is based on octahedral shear stress, the failure stress may be further modified to account for residual and hoop stresses. Thus, the updated IH model includes the effect of residual and hoop stresses. For comparison purpose, the life modeling output in ADORE consists of life results obtained by the original LP model, the generalized LP model, the GZ model and the generalized IH model. As a part of this implementation new data in the optional life modeling data records is now included to permit a change in any of the modeling parameters in the IH model.

3. ADORE User Manual

ADORE users manual has been updated to document the newly defined inputs and outputs.

4. ADORE Input Facility, AdrInput

The input facility AdrInput has been appropriately modified to provide newly required input data. Note that older data sets may not work with ADORE version 7.10. However, the old input data sets may be opened with new AdrInput facility to convert the data files for use with ADORE 7.10

5. ADORE Plot Facility, AdrPlot

The bearing life plot generated from output data file SOL7 now includes the GZ life.

6. ADORE Animation Facility, AGORE

There are no modifications to the animation facility (AGORE).

7. Test Cases

As usual the input data, print output and all plot data sets are included in the test cases 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.

8. Program File Contents:

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 and a **readMe.pdf** file, which provides latest update information and instructions for quick installation on the Windows machine:

Disk1

Update710.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.

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 programmable examples.

Disk2

***.f files:** ADORE FORTRAN-90/95 source files.

makeIntel.txt: Makefile for Windows 7 machine with Intel Fortran compiler.

makeLahey.txt: Makefile for Windows 7 machine with Lahey Fortran compiler.

makeUnix.txt: Makefile for Intel compiler on a Unix operating system.

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 files.

9. Program Installation

Quick installation steps are outlined in the readMe.txt file supplied on the program disk. More detailed installation instructions are included in the users manual.

9.1 ADORE Installation

Make files are provided in Disk2 directory for easy installation of ADORE for both the Intel and Lahey compilers for a Windows machine. The nmake command available with these compilers may be used to compile and create an executable code. In addition a make file is also included for a Unix operating system, running an Intel FORTRAN compiler. This file may also be used on a Macintosh computer, since Mac OS is essentially based on Unix.

In case of other computing platforms and/or operating systems, any of the supplied make file may be appropriately edited and used for ADORE installation.

9.2 Installation of 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 generate executables for these facilities.

The executable files for the three applications may then be transferred to appropriate run directory, an access to which may be defined by the environmental variable on the applicable computer system.

10. Contact Information

In the event of any questions and/or technical support please contact:

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