Altair

HyperWorks

Altair MotionView 2019 Tutorials

MV-3040: Durability and Fatigue Tools

altairhyperworks.com

MV-3040: Durability and Fatigue Tools

In this tutorial, you will learn how to:

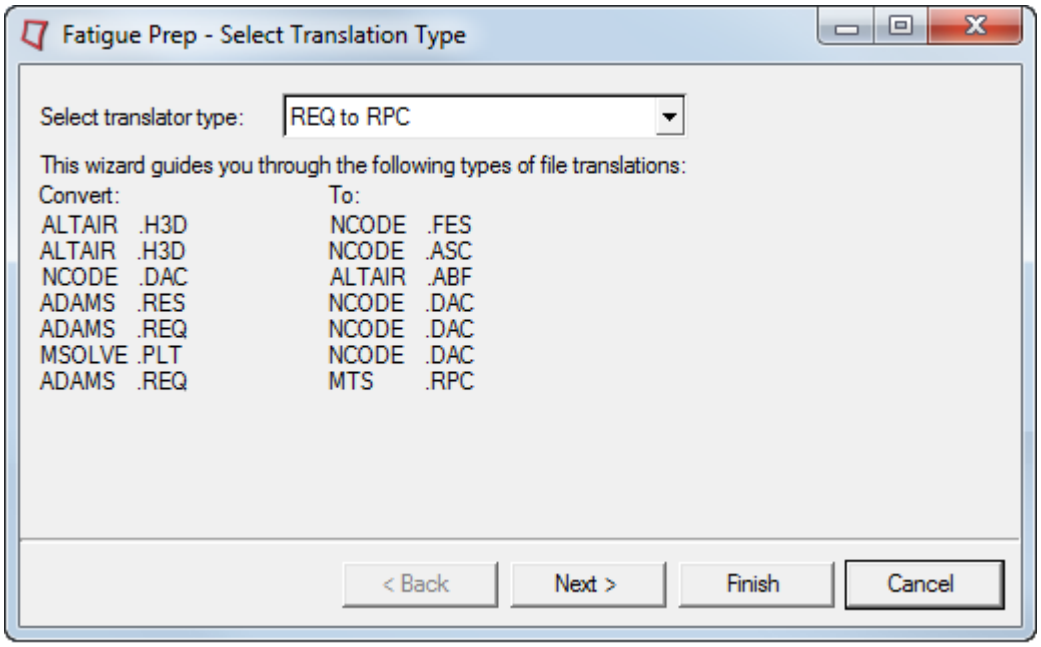
- Convert results from a multi-body simulation run into file formats which can be used for fatigue analysis using a tool like NCode
- Write a fatigue analysis file from the MotionView animation window (HyperView)

Tools

The following functionalities are used in this tutorial: ***Fatigue Prep***, ***Flex File Gen***, and ***build plots***.

The ***Fatigue Prep*** feature can be accessed by:

- On the ***Flex Tools*** menu, click ***Fatigue Prep***.

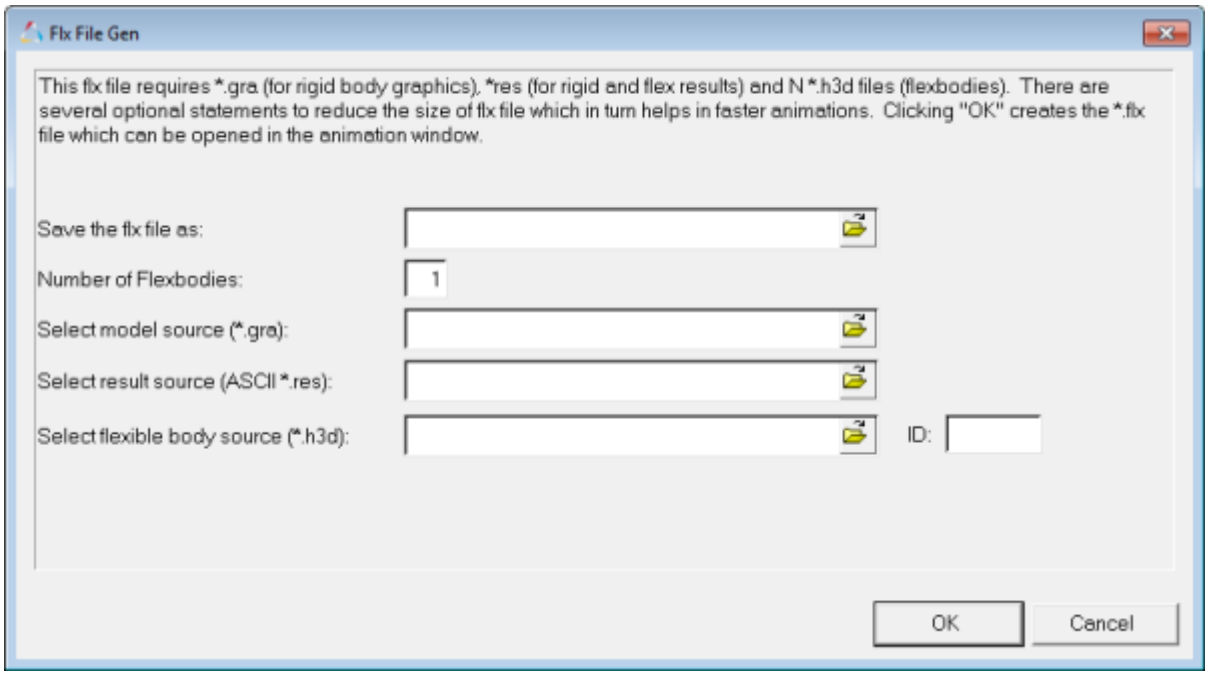


This panel translates the following files:

Original Format	Translated Format
Altair .H3D flexbody (modal content)	Ncode .FES/.ASC
Ncode .DAC	Altair .ABF
ADAMS .RES (modal participation factors)	Ncode .DAC
ADAMS .REQ files (loads information)	Ncode .DAC
Altair .PLT	Ncode .DAC
ADAMS .REQ files (loads information)	MTS .RPC

The ***Flex File Gen*** feature can be accessed by:

- On the ***Flex Tools*** menu, click ***Flex File Gen***.



The **Flex File Gen** feature allows you to create an `.flx` file using the **Flex File Gen** tool. This file references a `.gra` file (rigid body graphics), a `.res` file (flex and rigid body results), and `.H3D` files (flexbody graphics). These files are required to animate ADAMS results that contain flexbodies. The `.flx` file can be loaded directly into the animation window.

The ***build plots*** feature can be accessed by:

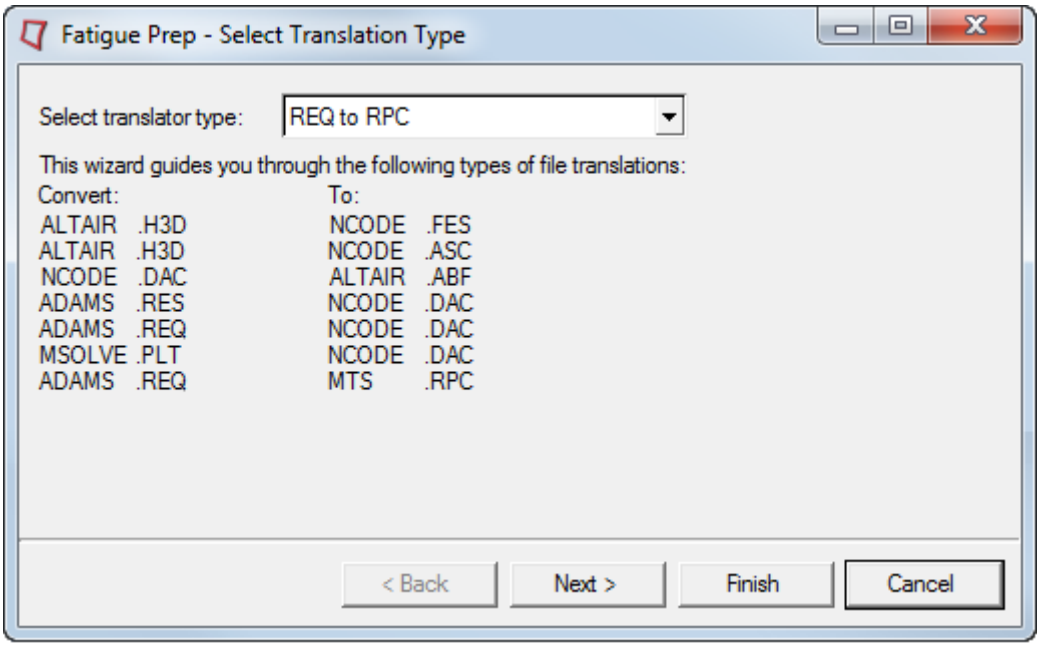
- Go to the HyperGraph client, and click the ***build plot*** icon, .

  The ***Build Plots*** panel constructs multiple curves and plots from a single data file. Curves can be overlaid in a single window or each curve can be assigned to a new window. Individual curves are edited using the ***Define Curves*** panel.

Step 1: Using the Fatigue Prep Wizard.

1. Start a new MotionView session.
2. Select the ***MBD Model*** window.

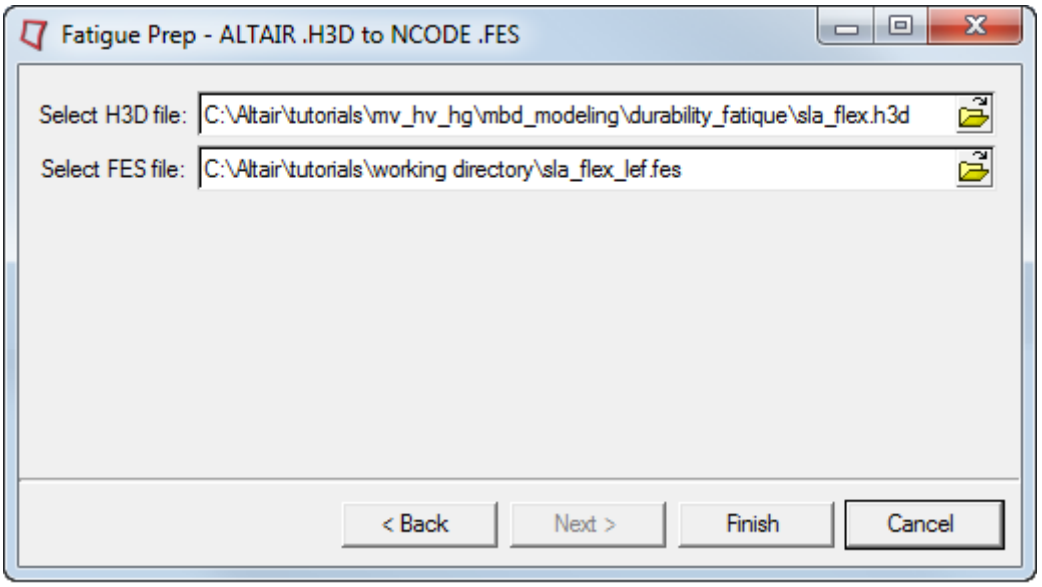
3. From the ***FlexTools*** menu, select ***Fatigue Prep***.



Fatigue Prep Wizard

The form shown above, describes the set of file translations possible using the **Fatigue Prep** wizard.

4. Use the drop-down menu to select the ***H3D to FES*** option.
5. Click ***Next***.
6. Specify the H3D file as `sla_flex.h3d`, located in the `mbd_modeling\durability_fatigue` folder.
7. Specify the FES file as `<working directory>\sla_flex_left.fes`.



Fatigue Prep Wizard

8. Click ***Finish***.

   The Altair flexible body pre-processor is launched and the FES file is created in your working directory.

   Using the **Fatigue Prep** wizard, you can convert your results files to `.fes`, `.asc` or `.dac` files. You can use these files for fatigue and durability analysis in Ncode's FE-Fatigue software.

Step 2: Converting ADAMS results from a REQ file to a DAC file.

The **Fatigue Prep** translator can be used to convert the request files created from an ADAMS run to DAC files. These DAC files can be further used for fatigue or durability analysis.

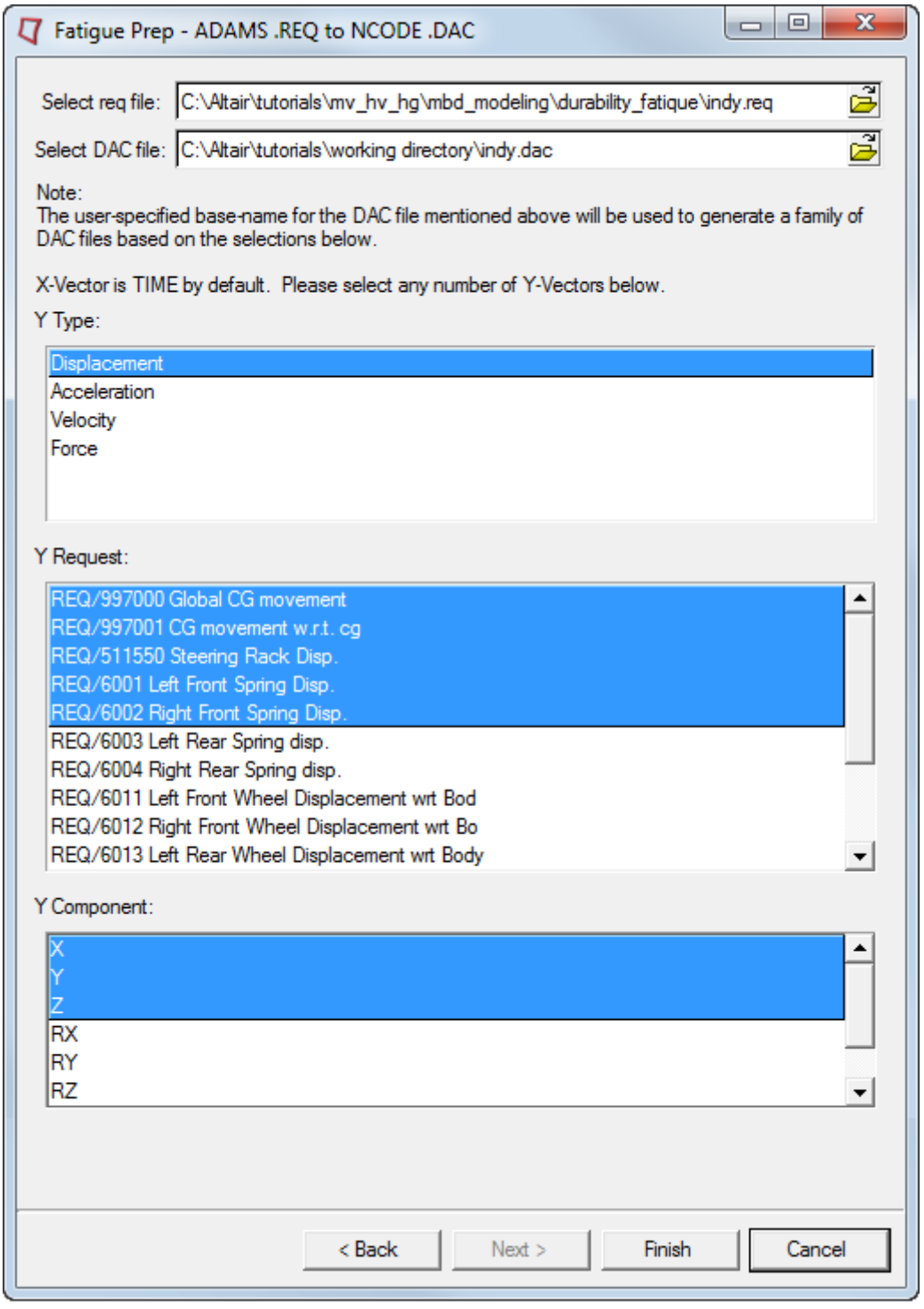
1. Start a new MotionView session.
2. Select the ***MBD Model*** window.
3. From the ***FlexTools*** menu, select ***Fatigue Prep***.
4. Select the ***REQ to DAC*** option.
5. Click ***Next***.
6. Click the file browser button attached to ***Select req file*** and select `indy.req` from the `durability_fatigue` folder.

   Note The DAC file format does not support unequal time steps since only frequency is specified, not each time step. Therefore your REQ file needs to have equal output time steps.

7. Click on the file browser attached to ***Select DAC file*** and specify `indy.dac` as an output filename in `<working directory>\`.
8. Under ***Y type***, select ***Displacement***.

   Once you select ***Displacement***, Y requests and Y components will populate the text boxes.

9. Select first five ***Y requests*** and the first three ***Y components***.



REQ to DAC translation

Note You can select any number of Y requests and Y components for REQ2DAC conversion.

10. Click the ***Finish*** button.

    The message ***Translation complete*** is displayed on the screen.

    MotionView generates 15 DAC files for each combination selected.

11. Click ***Cancel*** and close the window.
12. Change the application to ***HyperGraph 2D***.
13. From the ***Build Plots*** panel, load the file `indy_D_997000_X.dac` from `<working directory>\`.

    Note In this filename, D represents Displacement, 9970000 represents the request number, and X represents the component. This is how you get the information about the DAC file you are plotting.

14. Click ***Apply*** to see the plot.

    You may plot the corresponding request from the original REQ file for comparison.

Step 3: Using the Flex File Tool.

1. Start a new MotionView session.
2. From the ***Flex Tools*** menu, select ***Flex File Gen***.
3. The ***Flex File Generator*** dialog is displayed.

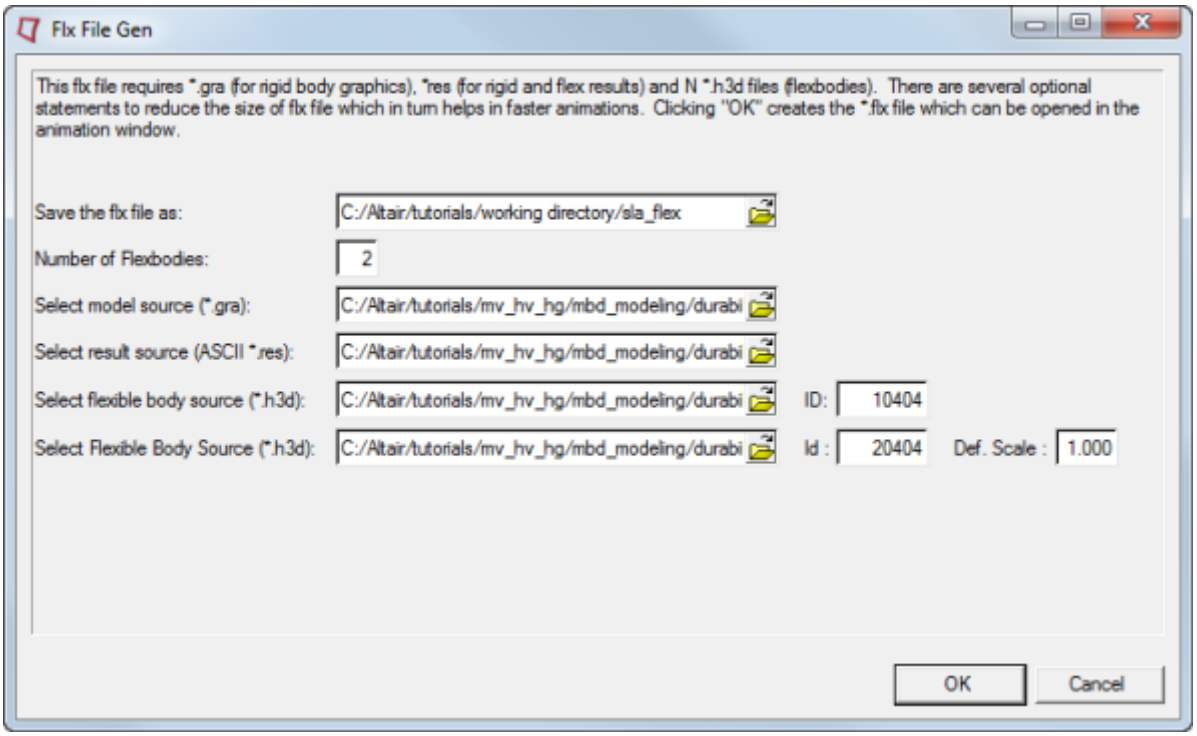
    This dialog lists the files you will need for this conversion.

4. Using the ***Save the *flx file as*** file browser, select your destination file to be `<working-dir>\sla_flex`.
5. In the ***Number of FlexBodies*** field, enter `2` since this model includes two lower control arms as flexible bodies.
6. From the ***Select model source (*.gra)*** file browser, select the `sla_flex.gra` file located in the `durability_fatigue` folder.
7. From the ***Select result source (ASCII *.res)*** file browser, select the `sla_flex.res` file located in the `durability_fatigue` folder.
8. Using the first file browser under ***Select flexible body source (*.h3d)***, select the `sla_flex.h3d` file located in the `durability_fatigue` folder.
9. Using the second file browser under ***Select Flexible Body Source (*.h3d)***, select the `sla_flex_m.h3d` file located in the `durability_fatigue` folder.

10. Under ***ID:*** field, enter `10404` and `20404` for the two h3ds, respectively.

    These values should correspond to the actual IDs of the flexible bodies in the ***ADM*** input deck of the ***ADAMS*** solver.

    The deformation of these flexible bodies during animation can be scaled using the ***Def. Scale*** field. In this case, accept the default value of `1.000`.



11. Click ***OK***.

    The translator is launched and the resulting ***FLX*** file is created in the destination directory.

12. Select the ***TextView*** window from the ***Select application*** list.

13. Click the arrow next to the ***Open Session*** icon,  , on the **Standard** toolbar and select ***Open Document***  .

14. Open the `sla_flex.flx` file.

    You should see the following contents of the FLX file:

```
•ModelSource("C:/Altair/hw/tutorials/mv_hv_hg/mbd_modeling/durability_fatique/sla_flex.gra")
•ResultSource("C:/Altair/hw/tutorials/mv_hv_hg/mbd_modeling/durability_fatique/sla_flex.res")
•FlexSource("C:/Altair/hw/tutorials/mv_hv_hg/mbd_modeling/durability_fatique/sla_flex.h3d", 10404)
•FlexSource("C:/Altair/hw/tutorials/mv_hv_hg/mbd_modeling/durability_fatique/sla_flex_m.h3d", 20404)
```

    Note To load transients results for selected time intervals check the ***Optional flx statements*** check-box to enter the ***Start Time***, ***End Time*** and ***Increment***.

    To load selected mode shapes from modal animation files for models with one or more flexible bodies, check the ***Optional flx statements for linear analysis*** check-box to enter the ***Start Mode*** and ***End Mode***.

    Additional statements are inserted in the FLX file reflecting the above mentioned parameters.

Step 4: Viewing Fatigue Results in the Animation Window.

1. Select ***HyperView*** using the ***Select application*** option on the toolbar.
2. Use the ***Open*** drop-down menu on the **Standard** toolbar (click the arrow next to the **Open Session** icon) to select ***Open Model***.
3. Use the ***Load model*** file browser to select the file, `sla_flex.flx` that you just created. The ***Load result*** field automatically populates with the same file name.
4. Click ***Apply***.
5. Click the ***Start/Pause Animation*** icon, to animate the model.

   Observe the animating model, which is a combination of rigid multi-bodies and two flexible lower control arms.
6. Click the ***Contour*** icon, on the **Results** toolbar.
7. Choose different options from the ***Result Type*** drop down menu, to view the various results available in the analysis result files.

For a detailed description of writing a fatigue analysis file from here, refer to the *Fatigue Manager* topic in the *HyperView User's Guide*.