



Altair

HyperWorks

Altair MotionView 2019 Tutorials

MV-4000: Eigen Analysis using ADAMS/Linear

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In this tutorial, you will learn how to:

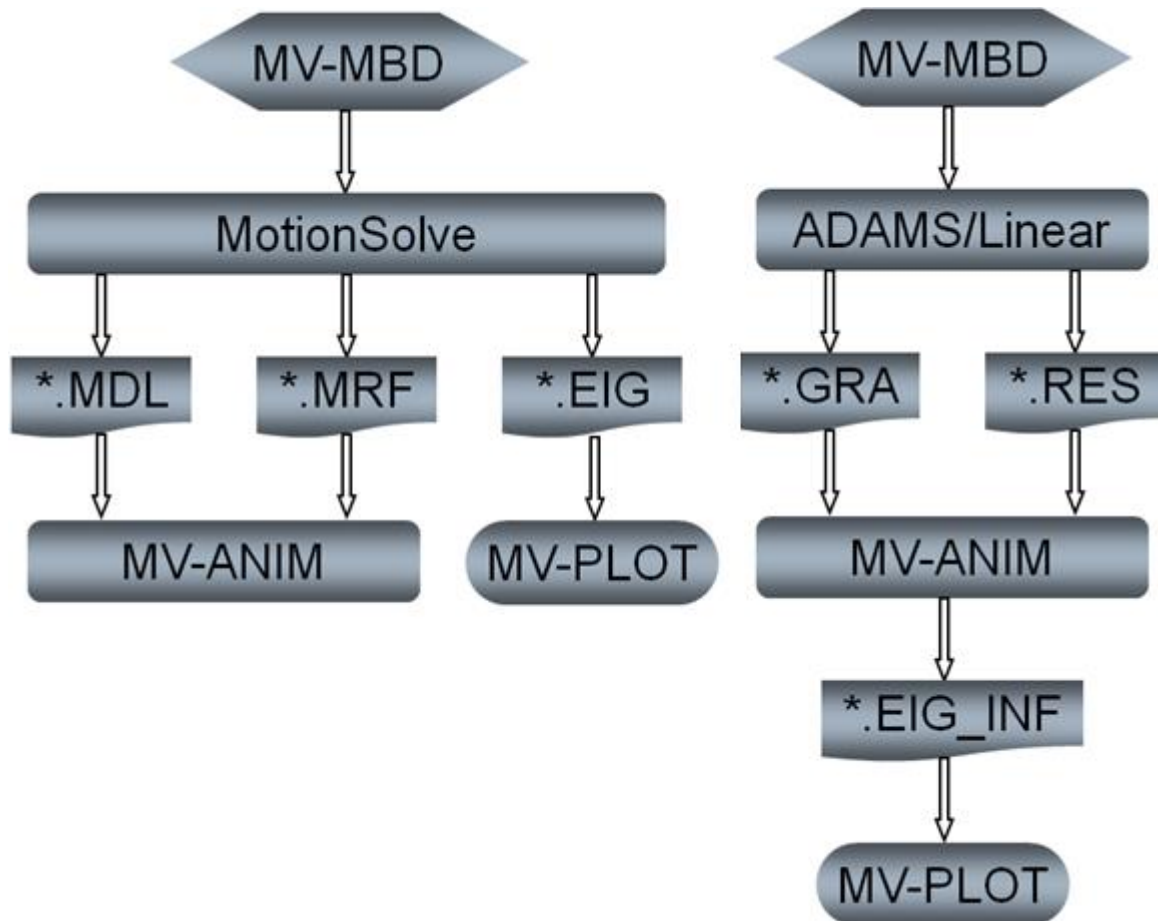
- Perform Static+Linear analysis on a MotionView model using ADAMS/Linear
- View the Static+Linear analysis results from ADAMS/Linear analysis using MotionView

Theory

This chapter deals with modal analysis of Multi-Body Dynamic (MBD) systems. This kind of analysis gives insight about system stability. Vehicle dynamics engineers often use the planar half-car model to analyze the ride quality of vehicles. You will use the ADAMS/Linear simulation to do a modal analysis of this type of model.



Process

Using the MotionView interface, you can obtain modal results in two ways: using MotionSolve and ADAMS/Linear. These two ways are illustrated in the flowcharts below:



Obtaining modal results with MotionSolve or ADAMS/Linear


Step 1: Obtaining Modal Results with ADAMS/Linear.

1. Start a new MotionView session.
2. Click the **Open Model** icon, , on the **Standard** toolbar.
OR
From the **File** menu select **Open > Model**.
3. From the **Open Model** dialog, locate and select the `halfcar_lin.mdl` file located in `mbd_modeling\externalcodes` folder.
4. Click the **Open** button to load the model.
5. From the **SolverMode** menu, select **ADAMS**.
6. Click the **Forms** icon, , on the **Model-General** toolbar and select the **Solution Options** form.
7. Verify that the **Solution type** is set to **Linear/Eig**.
This ensures the ADAMS solver will first do a static analysis and then a linear modal analysis on your model.
8. Click the **Run** icon on the **Model-Main** toolbar.

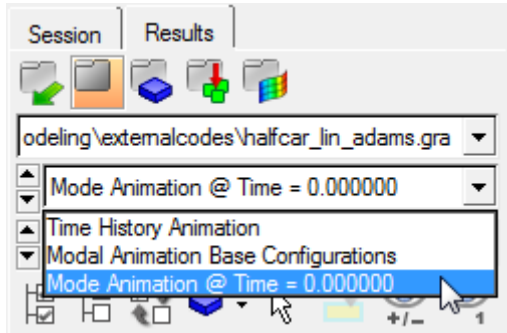
! Complete the following steps only if you have connected the ADAMS solver to the **Run** button in the MotionView interface through the preferences file. If ADAMS solver is not linked to MotionView, for the purpose of this tutorial, go to **Step 2: Viewing ADAMS/Linear Modal Results**.

9. From the **Script** combo box, change the script to **Altair Executable**.
10. Click **Run** to start the simulation.

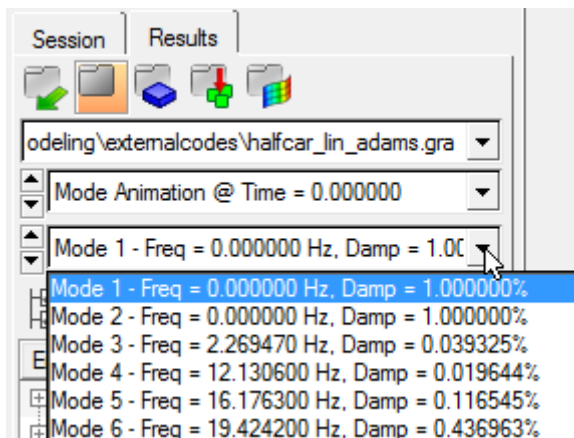
Step 2: Viewing ADAMS/Linear Modal Results.

1. Copy the files `halfcar_lin_adams.gra` and `halfcar_lin_adams.res`, located in the `mbd_modeling\externalcodes` folder, to your <Working directory>.
2. Start a new MotionView session.
3. Select **HyperView** from the **Select Application** list.
4. Click the **Load Results** icon, , from the **Standard** toolbar.
The **Load model and results** panel is displayed.
5. Click the **Load model** file browser and select the file `halfcar_lin_adams.gra`, located in <Working directory>.




6. Click the **Load results** file browser and select the file `halfcar_lin_adams.res`, located in <Working directory>.
7. Click **Apply**.
8. From the **Results Browser**, click on the arrow next to **Time History Animation** and use the **Change load case** drop-down menu to set the load case to **Mode Animation @ Time = 0.000000**.





9. The modes will automatically load and be displayed in the **Simulation** drop-down menu (located directly under the **Change load case** drop-down menu).





While an ADAMS Linear analysis may be performed multiple times through a transient simulation, in this example, the linear analysis was performed only at time step = 0.0.

10. Use the **Simulation** drop-down menu to select **Mode 3**.
11. Switch the view to **Top** .
12. Click the **Start/Pause Animation** icon, , to start transient animation.
The model cycles through its mode shapes/frequencies.
13. Click the **Start/Pause Animation** icon again, , to stop transient animation.

14. Switch to **Modal** animation, .

Note To visualize a single mode while using the ADAMS/Solver, the **Modal** icon is used, . For MotionSolve the **Start/Stop Animation** icon is used, .

15. Click the **Page Layout** icon  on the **Page Controls** toolbar and select a four-window layout .

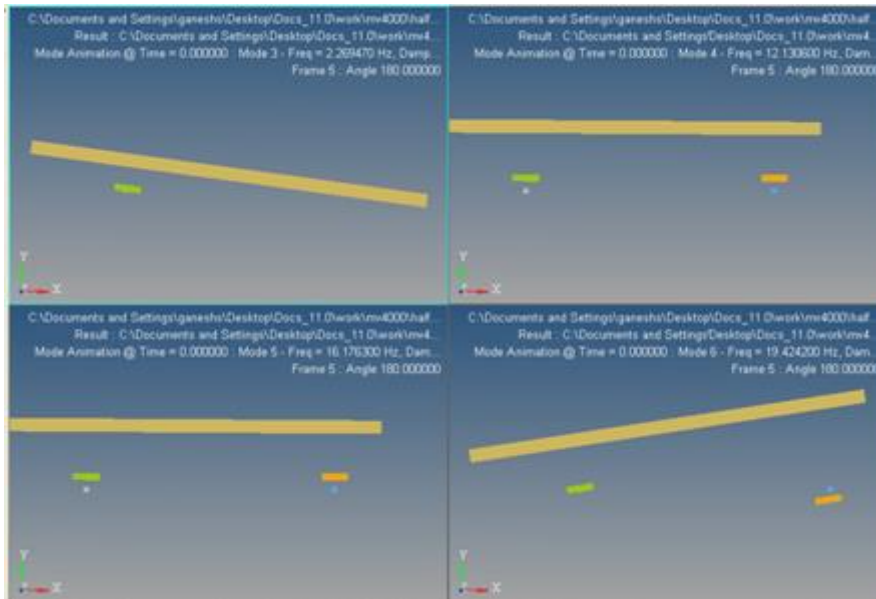
Note that the current window becomes one of the four windows.

16. Click one of the remaining windows to make it active.

17. From the **Load model** panel, click **Apply**.

18. Repeat steps 16 and 17 for the remaining windows (Note - the **Edit** menu can also be used to copy and paste windows into the four-window layout), and then load Simulation **Modes 4, 5, and 6**.

! Notice that the animations signify the pitch and bounce modes of car vibrations. The "wheel hop" resonance can also be seen in this example. Analyzing the above occurrences can help isolate vibrations by appropriately designing car suspensions.

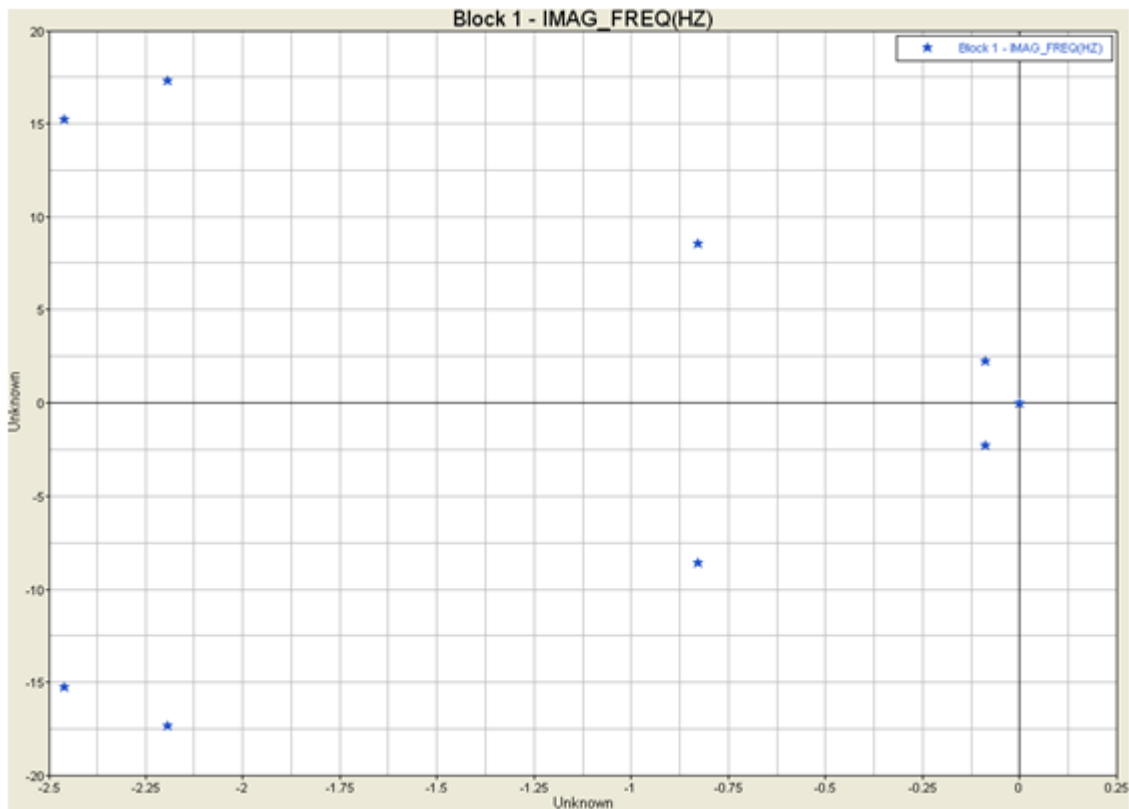


Linear modal animation – ADAMS/Linear results

Step 3: Plotting ADAMS/Linear Results for Eigenvalues in the Complex Plane.

A file named `halfcar_lin_adams.eig_inf` is generated in the directory `<working directory>` where the `gra` and `res` files are located following an ADAMS/Linear run. The extension `eig_inf` denotes eigenvalue information.

In this exercise, you will use this file to plot the model eigenvalues in the complex plane.



Eigenvalues in the complex plane