EMA Animation

The **Animation** tab shows the results of the modal analysis. Here you review the modes in a shape (frequency, damping, and mode shape), animate each mode on the geometry model, check the modes with the Modal Assurance Criterion (MAC), and import, export, or merge shapes.

EDM opens this tab automatically after you click **Calculate modes** in the Stability Diagram tab.

Fix Me! **Screenshot:** The full Animation tab, with the Shape pane (MAC table, modal parameters, mode shape table) on the left and a mode animating on the geometry model on the right.

The tab has two panes:

Shape- the MAC table, the list of modes, and the mode shape values for the selected mode.

Animation- the 3D geometry model, animated with the selected mode.

NOTE: You need a geometry model to animate the modes. Create or import it in the **Geometry** tab. The DOFs of the shape must use the point numbers and directions of the geometry.

NOTE: You cannot use this tab while a test is running.

Choosing a Shape

A **shape** is a set of modes saved by **Calculate modes**. A test can have several shapes, for example from different frequency bands or different selections of poles. Saved shapes are also listed under **Shape Tables** in the project tree. Click a shape there to open it.

First shape- Selects the shape to show in the tables and to animate.

The shape you open becomes the **active shape** of the test. Other tabs, such as **Synthesis**, use the active shape by default.

MAC

The Modal Assurance Criterion (MAC) compares two mode shapes and gives a value from 0 to 1. A value close to 1 means the shapes are the same. A value close to 0 means they are unrelated.

Calculate auto-MAC- (Default) Compares each mode of the **First shape** with every other mode of the same shape. Use this to check that your modes are distinct.

Calculate cross-MAC- Compares the modes of the **First shape** with the modes of the **Second shape**. Use this to compare two sets of results, for example from two different bands, estimation methods, or tests. When cross-MAC is selected, the tables below show the **Second shape**.

The MAC is calculated again automatically when you change the shape or the option.

Fix Me! **Screenshot:** An auto-MAC table with green cells on the diagonal and green or yellow cells elsewhere.

Reading the MAC table- Each row and column is one mode. The cells are colored to help you read the table:

Cell	Green	Yellow	Red
On the diagonal (a mode compared with the matching mode)	0.8 or more	0.5 to 0.8	Less than 0.5
Off the diagonal (two different modes)	0.2 or less	0.2 to 0.5	More than 0.5

In an **auto-MAC**, the diagonal is always 1. The values off the diagonal should be low (green). A high value (red) between two different modes means that they have nearly the same shape. They may be one mode that was picked twice in the Stability Diagram, or there may not be enough measurement points to tell them apart.

In a **cross-MAC**, the diagonal compares mode 1 with mode 1, mode 2 with mode 2, and so on. If the two shapes do not have the same modes in the same order, look for the highest value in each row instead.

Display MAC chart- Shows the MAC table as a 3D bar chart. Use **Default** to reset the view and **Export chart** to save the chart as a `.png` image.

Fix Me! **Screenshot:** The Modal Assurance Criterion window with the 3D MAC bar chart.

Modal Parameters

The **Modal parameters** table lists the modes in the shape:

Column	Description
Mode	The name of the mode, for example F#1.
Natural frequency (Hz)	The natural frequency of the mode.
Damping ratios (%)	The damping ratio of the mode.
Label	A description that you can type, for example “First bending”.
Mode participation (%)	(Multiple-reference data only) How strongly each reference excites the mode. The reference with the largest participation shows 100%. There is one column for each reference DOF.

Click a mode in the table to show its mode shape values below and to animate it.

TIP: For multiple-reference data, use the **Mode participation** columns to see which reference excites each mode best. A mode with low participation from all references may be poorly excited.

Mode Shapes

The **Mode Shapes** table shows the shape of the selected mode at each DOF:

Column	Description
Enable for animation	Select this to include the DOF in the animation.
DOFs	The response point and direction, for example +2Z.
Label	A description of the DOF.
Magnitude / **Phase** (or **Real** / **Imaginary**)	The value of the mode shape at the DOF.

When you change a value in the table, the animation is updated.

NOTE: Each DOF must have the format +1X or +1X:-2Y, cannot be empty, and cannot be repeated. If a DOF is not valid, a red message is shown below the table.

Fix Me! **Screenshot:** Close-up of the Modal parameters and Mode Shapes tables with one mode selected.

Right-Click Menu

Right-click anywhere in the Shape pane to open the menu.

Fix Me! **Screenshot:** The right-click menu open in the Shape pane.

Active Shape- Makes this shape the active shape of the test. EDM shows *"Active shape named ..."*.

Match Points- Links the DOFs of the shape to the points of the geometry model.

Animate Display- Links the DOFs to the geometry and starts the animation of the selected mode.

Mag Phase Shape / **Real Imaginary Shape**- Shows the mode shape values as magnitude and phase, or as real and imaginary parts.

Import Shape- Imports shapes from a Universal File (`.uff` or `.unv`). If a shape with the same name already exists, EDM shows *"Import failed. Cannot import repeatedly."* and nothing is imported.

Export Shape- Saves the shape to a Universal File (dataset 55). The date and time are added to the file name. Use this to send the results to other software, for example to compare with an FEA model.

Copy- Copies the selected rows of the **Modal parameters** table to the clipboard, so you can paste them into a spreadsheet.

Animation Pane

The Animation pane shows the selected mode on the geometry model. Use the toolbar above the model to control the view and the animation.

Fix Me! **Screenshot:** The Animation pane toolbar, with the main groups labeled (View, Display Settings, Animation Controls, Animation Settings, Utilities).

View- **Zoom In**, **Zoom Out**, **Auto Scale**, **Rotate**, and **Translate** the model.

Display Settings- Show or hide the points, measurement points, point numbers, lines, surfaces, and the origin. **Overlap Undeformed Model** shows the model at rest behind the animated model, which makes small motion easier to see.

Animation Controls- **Play**, **Pause**, and **Stop** the animation, step one frame at a time with **Previous Frame** and **Next Frame**, set the speed with the **Slow**/**Fast** slider, and **Increase** or **Decrease** the amplitude.

Animation Settings:

- **View**- Shows one model (**Single**) or two models side by side (**Left/Right**) or one above the other (**Upper/Lower**). Use the split views to compare two modes or two shapes. Click a view to show its shape and mode in the Shape pane.
- **Interpolation**- Moves the points that were not measured, based on the measured points around them.
- **Smooth**- Draws the surfaces smoothly.
- **Contour**- Colors the model by the size of the motion.
- **Node Lines**- Shows the lines where the mode has no motion.
- **Orbit**- Traces the path of selected points.
- **Arrows**- Shows the direction of the motion.

Utilities- **Save Image** saves a picture of the model. **Save Video** saves the animation as a `.gif` or `.avi` file.

Fix Me! **Screenshot:** A Left/Right split view comparing two modes, with Contour selected.

Fix Me! Confirm the 3D toolbar names against the current software, and add any options most users need that are missing here.

Merge Modes

When a structure is too large to measure in one test, you can measure it in parts (partial mode sets), each part with some of the points. **Merge Modes** combines the partial mode sets into one shape that covers the whole structure.

Click **Merge Modes** in the Shape pane to open the **Merge Modes** window.

Fix Me! **Screenshot:** The Merge Modes window with two partial mode sets added and one set as the target.

To merge mode sets:

1. In **Partial Model Set**, select a shape and click **Add Partial Set to Merged Mode**. Repeat for each partial set.
2. Select the set whose frequencies and damping you want to keep, and click **Set as Target Mode**. It is marked with a check mark (√).
3. Set the **Frequency** and **Damping** tolerances. These set how close the modes of each partial set must be to the target modes.
4. Click **Merge Modes**.
5. Type a name for the merged shape and click **OK**. The name can contain only letters, numbers,

and underscores (_).

The merged shape is saved as a new shape and opened in the Shape pane.

Delete- Removes the selected set from the merge list. The shape itself is not deleted.

Requirements for merging:

- Every partial set must have the same number of modes as the target, in the same order, and each mode must be within the frequency and damping tolerances of the matching target mode. Otherwise EDM shows a message and names the set that must be calculated again.
- The partial sets cannot have the same DOFs. Each DOF must be measured in only one set.
- You must add at least two sets and choose a target.

Fix Me! The tolerance check in Merge Modes currently treats the % value as a fraction (the default 1% allows a 100% difference). Confirm the intended behavior with development before publishing the tolerance description.

TIP: Use the same reference point, the same frequency band, and the same poles (as close as possible) for every partial set. Then check the merged shape with an auto-MAC.

FAQs

Why does the model not move?- Check that the DOFs in the Mode Shapes table use point numbers that exist in the geometry, and that **Enable for animation** is selected. Then right-click and click **Animate Display**.

Two modes have a high MAC value. What does it mean?- The two modes have nearly the same shape. Check whether the same mode was picked twice in the Stability Diagram, or whether more measurement points are needed to tell them apart.

Why can't I delete a shape?- The active shape cannot be deleted. Open a different shape first, then delete it from **Shape Tables** in the project tree.

How do I use the results in other software?- Right-click the Shape pane and click **Export Shape** to save a Universal File. Use **Copy** to paste the modal parameters into a spreadsheet.

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