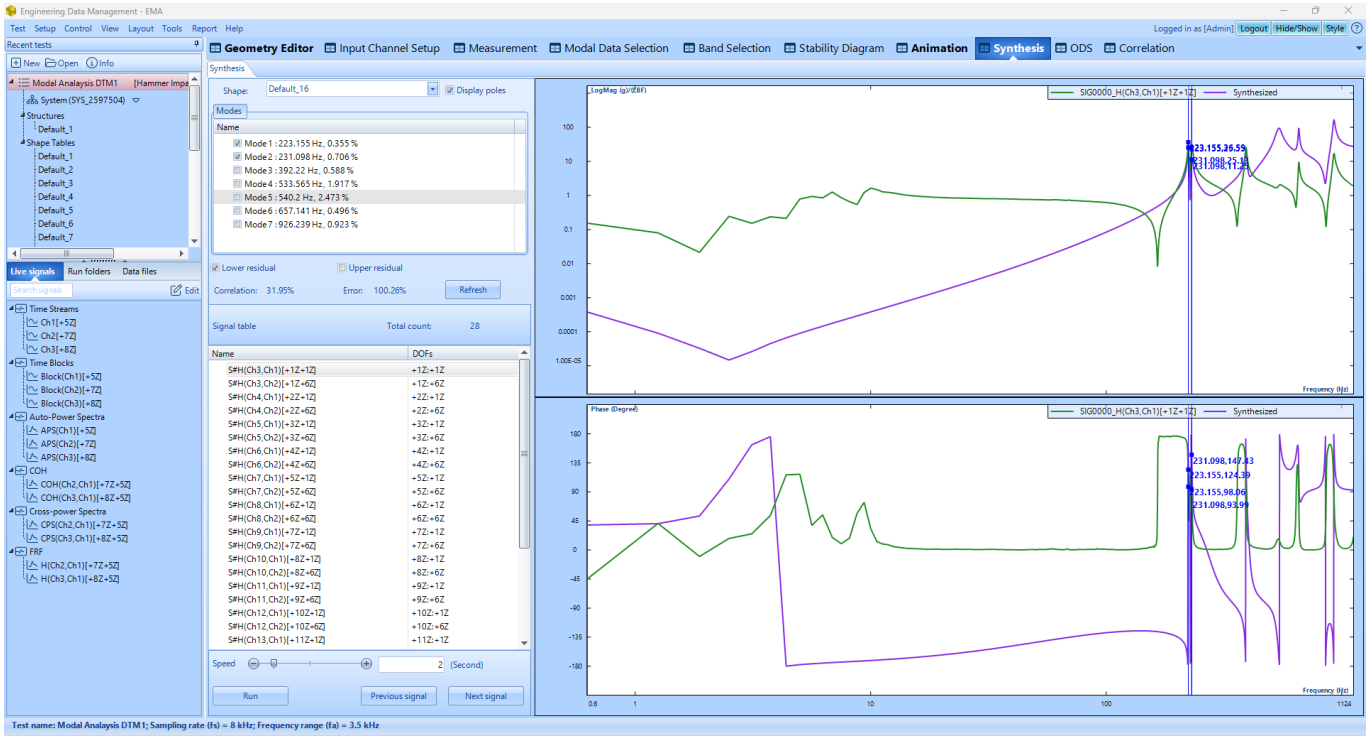
EMA Synthesis

The **Synthesis** tab checks how well your modal results describe the measured data. EDM uses the modes in a saved shape to rebuild (synthesize) each FRF, then draws the synthesized FRF on top of the measured FRF. If the modes were picked well, the two curves lie close together in the frequency band that was curve-fitted.



Settings- the shape to use, the list of its modes, the residual options, and the fit results (**Correlation** and **Error**).

Signal table- the measured FRFs that were used to calculate the shape.

Chart- the measured FRF and the synthesized FRF for the signal selected in the table. The upper pane shows the magnitude and the lower pane shows the phase.

Choosing a Shape

Shape- Select the shape that you want to check. The list shows all the shapes saved in the current test. When you change the shape, EDM loads its measured FRFs and calculates the synthesis again.

Note When you open the Synthesis tab, EDM selects the shape that is active in the **Animation** tab.

Refresh- Updates the list of shapes, reloads the measured FRFs, and calculates the synthesis again. Use this if you have calculated a new shape or changed a shape since you opened the tab.

Modes

The **Modes** list shows each mode in the shape, for example *Mode 1 : 125.431 Hz , 1.254 %* (frequency and damping).

Display poles- When this is selected, a vertical cursor is drawn on the chart at the frequency of each mode that is checked in the **Modes** list. Click a mode in the list to check or clear it. Use the cursors to see whether each mode lines up with a peak in the measured FRF.

Note: The **Modes** list only controls which cursors are shown. The synthesis always uses all the modes in the shape that are inside the curve-fitted frequency band. Clearing a mode does not remove it from the synthesis.

Residuals

The synthesis uses only the modes inside the curve-fitted band. Modes outside the band still affect the FRF inside the band. Residual terms account for these out-of-band modes.

Lower residual- Adds a term for the effect of modes **below** the band. This mostly improves the fit at the low-frequency end of the band.

Upper residual- Adds a term for the effect of modes **above** the band. This mostly improves the fit at the high-frequency end of the band.

Both are selected by default. When you change either option, EDM calculates the synthesis again.

Fix Me! **Screenshot:** The same FRF shown twice, once with the residuals selected and once with them cleared, to show how the residuals improve the fit near the ends of the band.

TIP: If the synthesized curve fits well near the modes but is offset from the measured curve near the ends of the band, make sure both residuals are selected.

Signal Table

The signal table lists the measured FRFs used by the shape, with each signal's **Name** and **DOFs**. **Total count** shows the number of signals.

Click a signal in the table to show it on the chart:

- The **measured** FRF is drawn in green.
- The **synthesized** FRF is drawn in purple and labeled **Synthesized**.

Only the frequency band that was curve-fitted in the Stability Diagram is shown. If the shape combines modes from several bands, each band is shown.

Stepping through signals:

Previous signal / Next signal- Shows the previous or next signal in the table. At the end of the

table, it goes back to the start.

Run- Steps through the signals automatically. The button changes to **Stop** while it runs. Click **Stop** to stop.

Speed (Second)- Sets how long each signal is shown when **Run** is used, from 1 to 10 seconds. The default is 2 seconds.

These controls are not available when the table has only one signal.

Fix Me! **Screenshot:** Close-up of the signal table and the Previous signal, Run, Next signal and Speed controls.

Correlation and Error

When you select a signal, EDM compares the synthesized FRF with the measured FRF over the curve-fitted band and shows two values:

Correlation- How similar the shapes of the two curves are, from 0% to 100%. 100% means the synthesized FRF has exactly the same shape as the measured FRF. A value close to 100% means the modes describe this signal well.

Error- The size of the difference between the two curves, compared with the size of the synthesized FRF. 0% means the curves are the same. Lower is better.

Fix Me! **Screenshot:** Close-up of the Correlation and Error values for a well-fitted signal.

What to look for:

- High **Correlation** and low **Error** for most signals means that the modes and the band were chosen well.
- A low **Correlation** for only a few signals may point to a bad measurement or a wrong DOF for those signals. Check them in Modal Data Selection.
- A low **Correlation** for most signals may mean that a mode was missed or a wrong pole was selected. Look for peaks in the measured FRF that have no cursor (with **Display poles** selected), and go back to the Stability Diagram.

NOTE: Error is calculated relative to the synthesized FRF, so it can be greater than 100% when the synthesized FRF is much smaller than the measured FRF. If the value is extremely large, it is shown as **NaN**.

NOTE: The **Correlation** and **Error** values are updated only when you select a signal. After you change the shape, select a signal again to update them.

Right-Click Menu

Right-click on the chart to open the menu.

Fix Me! **Screenshot:** The right-click menu open on the Synthesis chart, with the Vertical Axis

submenu showing.

Zoom Back- Returns to the previous zoom level.

Un-zoom All- Returns to the full view of the chart.

Remove Cursor- Removes one mode cursor from the chart.

Remove All Cursor- Removes all the mode cursors from the chart.

Horizontal Axis- Shows the frequency axis on a **Linear** or **Log** scale.

Vertical Axis- Changes how the FRFs are displayed:

- **Magnitude, dB + Phase**
- **Log Magnitude + Phase**
- **Magnitude + Phase**
- **Real + Imaginary**

Edit Legend- Changes the names and colors of the curves in the legend.

Export Signal- Saves the measured FRF and the synthesized FRF of the signal shown on the chart to a Universal File Format (`.unv`) file. Only the curve-fitted band is exported. Select a signal in the table before you use this option.

FAQs

Why is the signal table empty?- EDM could not find the measured signals that were used to calculate the shape. They may have been moved, renamed, or deleted. Shapes imported from a file also have no measured signals to compare with.

Why does clearing a mode not change the synthesized FRF?- The **Modes** list only controls the cursors on the chart. All the modes in the shape are always used in the synthesis.

Why does the Shape go back to a different shape when I return to this tab?- When you open the Synthesis tab, EDM selects the shape that is active in the **Animation** tab. To check a different shape every time, make it the active shape in the Animation tab.

What is a good Correlation value?- There is no fixed limit, but a well-fitted signal usually has a Correlation above 90%. Compare signals with each other: the ones with a much lower value need attention.

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https://help.go-ci.com/ - **Crystal Instruments Help**

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