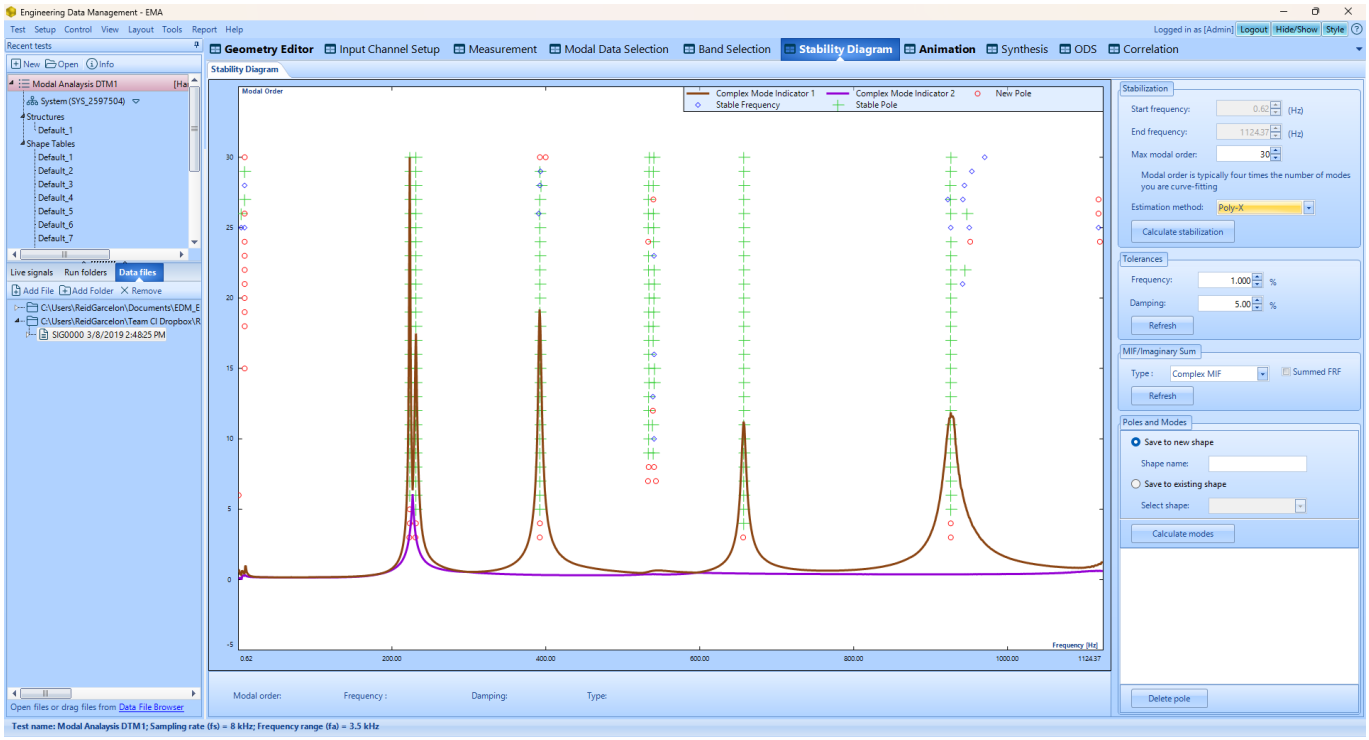
EMA Stability Diagram

The **Stability Diagram** tab is the third step of Modal Analysis in EDM, after EMA Band Selection. The Stability Diagram tab features a configurable plot with parameter control over the modal order, estimation method, Mode Indicator Function type, and pole selection.

EDM curve-fits the FRFs in the selected frequency band many times, using a higher model order each time. Poles that stay at the same frequency and damping as the model order increases are real modes of the structure. You pick these poles, and EDM calculates the mode shapes from them. It also displays Pole information for modal order frequency and damping ratio. Selected poles are used in mode calculation.



The tab has two main areas:

Settings panel- holds the calculation settings, the information about the selected pole, the list of selected poles (modes), and the options for saving the mode shapes.

Chart- shows the stability diagram. The horizontal axis is frequency and the vertical axis is the model order. A MIF curve from the same band is drawn behind the poles to help you see where the modes are.

Calculating the Stability Diagram

The settings in the **Stabilization** group control the calculation.

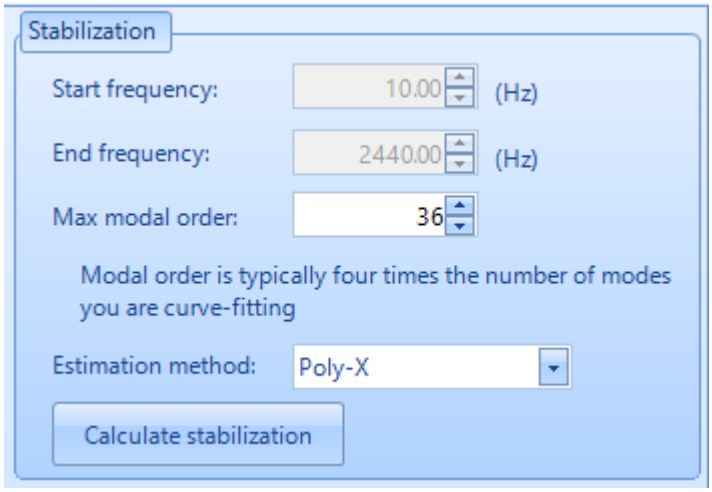
Start frequency / End frequency- The frequency band from the Band Selection tab. These values cannot be changed here. To change them, go back to Band Selection.

Estimation method- The curve-fitting method used to find the poles:

- **Time Domain**- The standard method. Always available.
- **Poly-X**- A frequency-domain method. Available only if your license includes it.
- **SSI**- Stochastic Subspace Identification. Available only for Operational Modal Analysis (OMA) tests, and only if your license includes it.

Max modal order- The modal order is a user defined number which is used to determine the highest order of the polynomial curve of best fit. The diagram has one row for each model order up to this value. As the hint in the tab says, the modal order is typically four times the number of modes you are curve-fitting. If the value is too high for the data, EDM lowers it automatically and shows a message, for example *"Max Modes will reset to 24."*

Click **Calculate stabilization** to calculate the diagram. A progress window opens. You can cancel the calculation from this window.

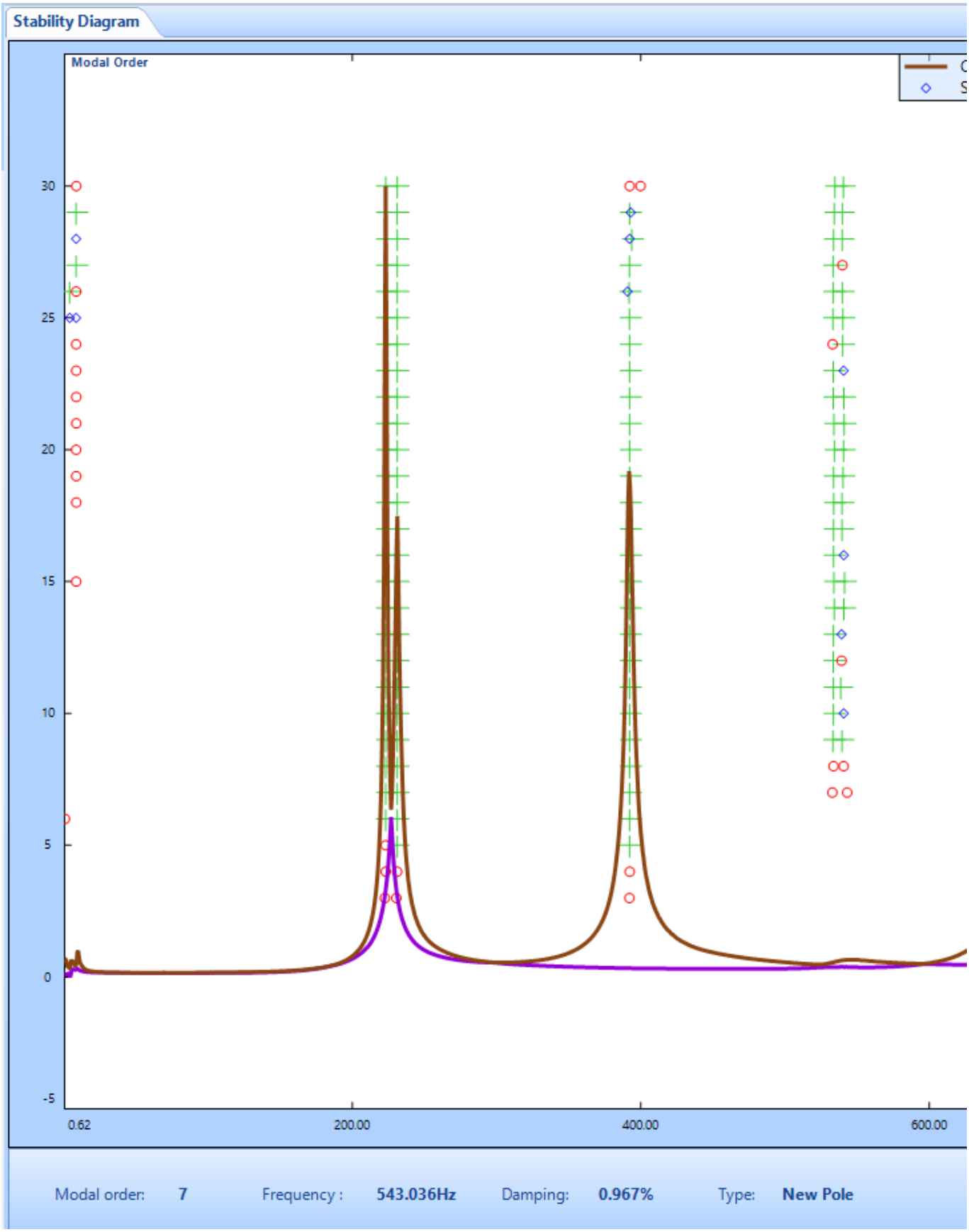


Reading the Stability Diagram

Each symbol on the diagram is a pole found at one model order. EDM compares each pole with the poles at the model order below it and marks it with one of these symbols:

Symbol	Pole type	Meaning
Green plus (+)	**Stable Pole**	Both the frequency and the damping are within the tolerances of a pole at the lower model order.
Blue diamond	**Stable Frequency**	The frequency is within the tolerance, but the damping is not.
Red circle	**New Pole**	The pole does not match a pole at the lower model order.

Real modes usually show as a vertical column of green **Stable Pole** symbols that continues over many model orders, often at a peak or valley of the MIF curve. Poles that appear at random places, or only at a few model orders, are usually caused by noise or by the math of the curve fit, and should not be selected.



When you move the mouse over a pole, the **Poles and Modes** group shows its information:

Frequency- The natural frequency of the pole, in Hz.

Damping- The damping ratio of the pole, in %.

Modal order- The model order (row) where the pole was found.

Type- The pole type: Stable Pole, Stable Frequency, or New Pole.

Tolerances

The **Tolerances** group sets how close a pole must be to a pole at the lower model order to be called stable.

Frequency- The largest allowed difference in frequency, in %. The default is 1%.

Damping- The largest allowed difference in damping, in %. The default is 5%.

Click **Refresh** in the Tolerances group to classify the poles again with the new tolerances. This does not run the calculation again.

NOTE: Clicking **Refresh** in the Tolerances group removes all the poles that you have selected. Set the tolerances before you select poles.

MIF / Imaginary Sum

The **MIF/Imaginary Sum** group sets which curve is drawn behind the poles: **Multivariate MIF**, **Complex MIF**, **Real MIF**, or **Imaginary Sum**. See the Band Selection page for the differences between them. Choose a type, then click **Refresh** in this group to redraw the curve. Your selected poles are kept.

Selecting Poles

Each pole that you select becomes one mode in the results.

To select a pole: simply move your mouse over the stable pole and left click

NOTE: Some rules apply when you select poles:

- You can select only one pole at each frequency. If you try to add a second pole at the same frequency, EDM shows a message.
- The number of selected poles can be at most half of the **Max modal order**. To select more modes, increase the **Max modal order** and calculate again.
- If **Auto select pole in stability pole** is selected in the Band Selection tab, EDM selects the poles that stay stable over many model orders automatically after the calculation. Check the automatic selection, and add or remove poles as needed.

To remove poles:

Delete pole- Select one or more modes in the list and click **Delete pole**. Hold **Ctrl** or **Shift** to select more than one mode.

Remove Cursor- Right-click the chart, point to **Remove Cursor**, and click the pole you want to remove.

Remove All Cursor- Right-click the chart and click **Remove All Cursor** to remove all the selected poles.

TIP: Zoom in on a mode to make it easier to pick the right pole. When you are zoomed in, use the scroll bars or hold the middle mouse button and drag to move around the chart.

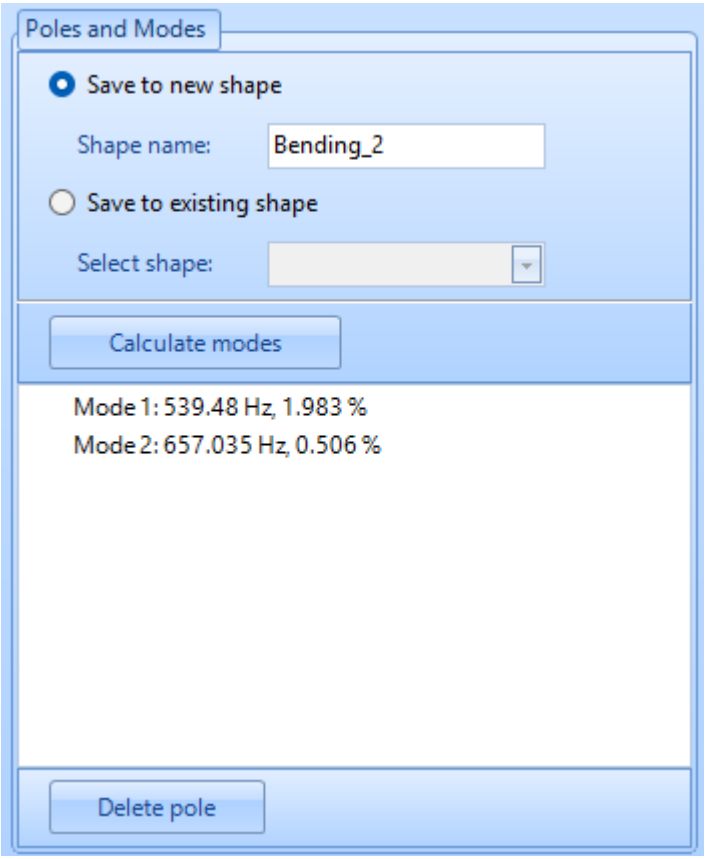
Calculating the Mode Shapes

When you have selected the poles, choose where to save the results:

Save to new shape- Saves the modes to a new shape. Type a name in **Shape name**. The name can contain only letters, numbers, and underscores (_). It must be different from the names of the existing shapes, and it cannot contain `Default_`.

Save to existing shape- Adds the modes to a shape that you choose from **Select shape**. Use this to combine modes from several frequency bands into one shape. The existing shape must use the same DOFs, and its frequency band must not overlap the band that you are fitting now.

Then click **Calculate modes**. EDM calculates the mode shapes, saves them to the shape, and opens the **Animation** tab. The message *"The modal shapes are calculated successfully."* is shown.



NOTE: If EDM shows *"Name isn't unique, or FRF is different, or the frequency band overlaps"*, then either the shape name is already used, or the existing shape you chose has different DOFs or an overlapping frequency band. Use a different name, or choose a different shape.

FAQs

Why does the diagram show only red New Pole symbols?- The data may be noisy, the band may not contain a clear mode, or the tolerances may be too tight. Check the FRFs and the band in Band Selection, try a higher **Max modal order**, or increase the tolerances and click **Refresh**.

Why can't I add a cursor?- Make sure that the mouse is over a pole symbol when you right-click. You also cannot add a pole at a frequency that is already selected, or select more than half of the **Max modal order** in poles.

Why did my selected poles disappear?- Clicking **Refresh** in the Tolerances group removes the selected poles. Changing the signal selection in Modal Data Selection also clears the Stability Diagram.

Why is Poly-X or SSI not in the Estimation method list?- These methods need a license option. SSI is also available only for OMA tests. Contact support@go-ci.com for more information about your license.

How many modes should I select?- Select one pole for each column of stable poles that lines up with a peak or valley of the MIF curve. Each pole you select becomes one mode in the results.

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

Permanent link:
https://help.go-ci.com/modal:modal-analysis:stability-diagram

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