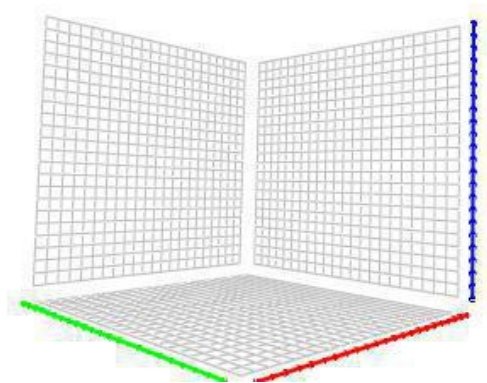# 3D graphs in MatDeck

There are two ways of inserting a 3D graph in MatDeck. You can place it in the document like an object, or create a graph widget.

To insert a graph like an object, you can use the Insert tab > 3D Graph icon and then choose the place in the document to place that graph.

Empty 3D graph object

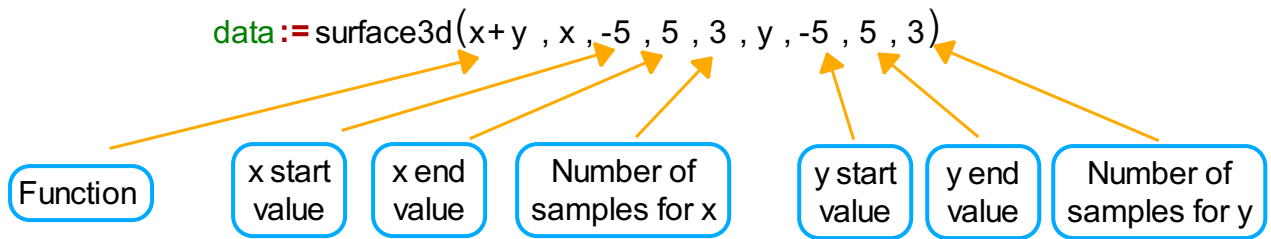To insert a graph widget, create a variable that contains the graph3d function within itself.

$$a1 := \text{graph3d}(0 \text{ , data matrix})$$

The zero value in the first argument means that this is the top level widget, because widgets are parent-child based.
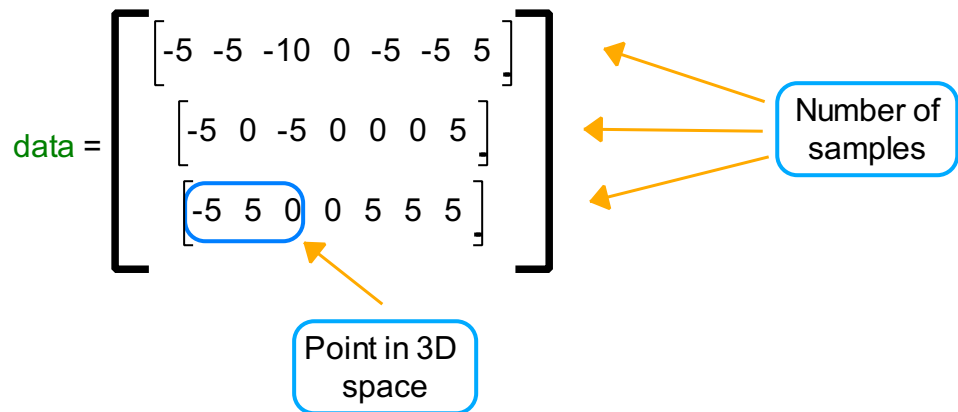For more information about widgets see GUIUserManual.pdf from the User Manual document.
When a widget is created it is not visible, you can choose to embed it into a document (function **embed widget()**) or you can choose to show it as an independent object in a new window on the screen (function **show()**).
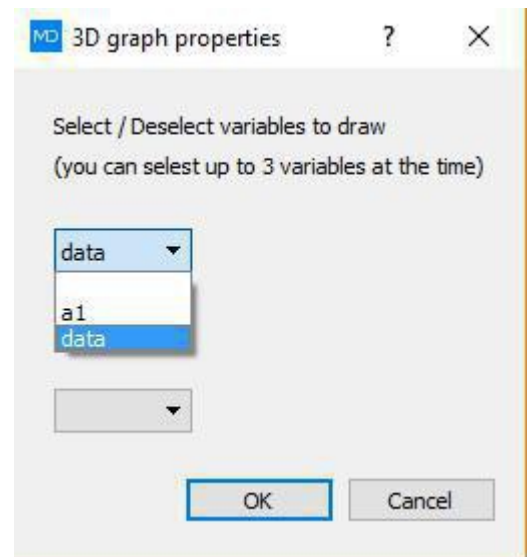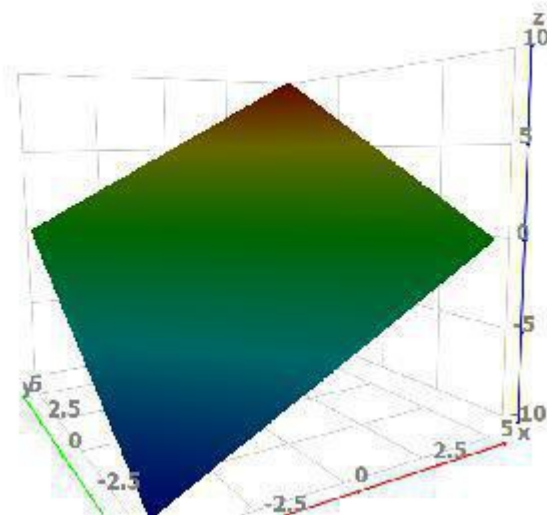
MatDeck 3D plots and handles the data stored in a column vector which has vectors within itself. Every vector represents data for one slice of the graph. To create the data use the function **surface3d.**

$$\text{data} := \text{surface3d}\big(x+y\ ,\ x\ ,\ \text{-5}\ ,\ 5\ ,\ 3\ ,\ y\ ,\ \text{-5}\ ,\ 5\ ,\ 3\big)$$

Function | x start value | x end value | Number of samples for x | y start value | y end value | Number of samples for y

Data that we have created with the surface3d function looks like this.

$$\text{data} = \begin{bmatrix} \begin{bmatrix} -5 & -5 & -10 & 0 & -5 & -5 & 5 \end{bmatrix} \\ \begin{bmatrix} -5 & 0 & -5 & 0 & 0 & 0 & 5 \end{bmatrix} \\ \begin{bmatrix} -5 & 5 & 0 & 0 & 5 & 5 & 5 \end{bmatrix} \end{bmatrix}$$

Number of samples

Point in 3D space

To plot the data variable, open the context menu on the 3D graph object, go to Properties and select the variable from the drop down list.

3D graph properties

Select / Deselect variables to draw
(you can selest up to 3 variables at the time)

data

a1
data

OK   Cancel

Changes to the number of samples argument will affect the accuracy of the graph

$\text{data1} := \text{surface3d}\left(\sin\left(x^2 - y^3 \right), x, -5, 5, 50, y, -5, 5, 50 \right)$

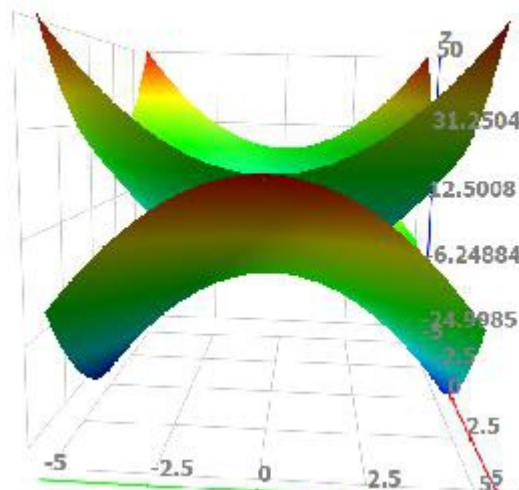$\text{data2} := \text{surface3d}\left(\sin\left(x^2 - y^3 \right), x, -5, 5, 10, y, -5, 5, 10 \right)$
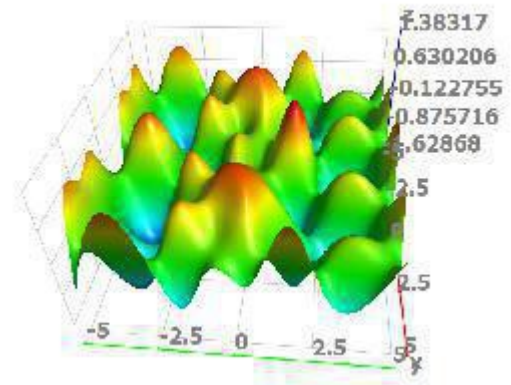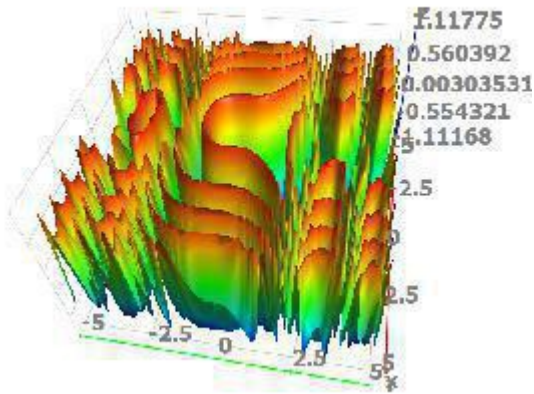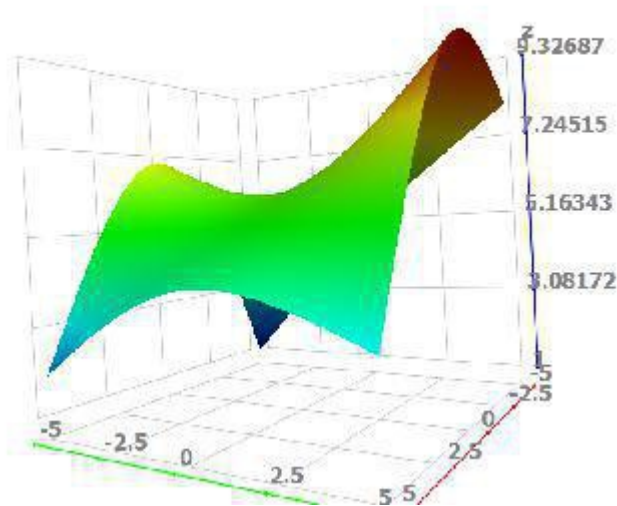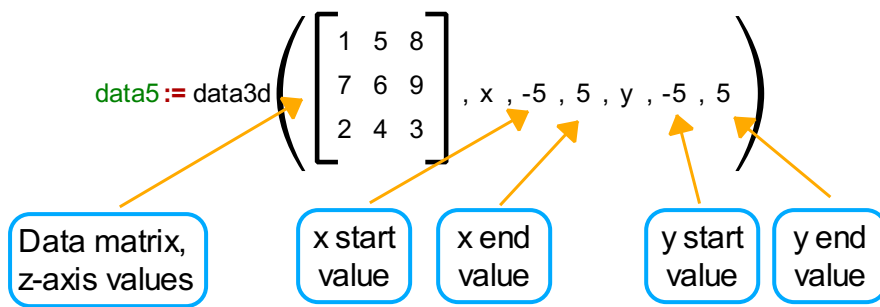

If we want to plot several graphs on the same graph object, create the graphs data, save it in variables, and from the 3D graph properties menu choose variables that you want to plot.

$$\text{data3} := \text{surface3d}\left(x^2 + y^2, x, -5, 5, 50, y, -5, 5, 50 \right)$$

$$\text{data4} := \text{surface3d}\left(x^2 - y^2, x, -5, 5, 50, y, -5, 5, 50 \right)$$

Another useful function is **data3d**. This function creates a vector to 3D plot from the inserted matrix, where the matrix values are considered as the z-axis data.

$$\text{data5} := \text{data3d}\left(\begin{bmatrix} 1 & 5 & 8 \\ 7 & 6 & 9 \\ 2 & 4 & 3 \end{bmatrix}, \text{x}, -5, 5, \text{y}, -5, 5 \right)$$

Data matrix,
z-axis values

x start
value

x end
value

y start
value

y end
value

When we talk about plot formating, there are a wide range of formating options that you can implement in your graph: add axis names, change axis resolution and steps, change axis ratio, show the coordinate planes, find intersections and peaks, choose between linear and cubic splines, show origin points,...