

1 Help on meshgrid

You can use the `meshgrid` command to generate two arrays containing the x- and y-coordinates at each position in a rectilinear grid. For example `[X,Y] = meshgrid(-5:1:5)` returns two 11×11 matrices - the X matrix defines the x-coordinates and the Y matrix the y-coordinates at each position in an 11×11 grid. Try typing this command and view the contents of X and Y.

This command is sometimes convenient for computing functions of 2 variables over a rectangular region of the coordinate system. For example, if we wanted to numerically compute the function $f(x, y) = xy$ over a set of points in the range $x \in [-5, 5]$ and $y \in [-5, 5]$, this could be accomplished using element-wise operations on our meshgrid matrices by the command `Z = X.*Y`. This is much simpler than cycling through each point in the space $[-5, 5] \times [-5, 5]$ to compute each point of the function.

For some standard operations such as multiplication, division, and power, element-wise operations are specified by a period in front of the standard operator: `Z=X.*Y` , `Z=X./Y` , `Z=X.^Y` . This shouldn't be confused with `Z=X*Y` which is interpreted as a *matrix* multiplication. Most other built-in math operations such as `sin(x)`, `cos(x)` and `exp(x)` are naturally element-wise.

Example: Say you want to generate a sampled representation of the 2-D sinusoid $f(x, y) = x \sin(xy)$ in the range $x \in [-5, 5]$ and $y \in [-10, 10]$. This could be accomplished using with the following

```
[x,y]=meshgrid(-5:1:5,-10:1:10);  
z=x.*sin(x.*y);
```

A finer sampling of the function can be obtained by decreasing the step size, for example using `meshgrid(-5:.2:5,-10:.2:10)`.

You can then display the function by typing `z` (return) or by using the `mesh` or the `image` command.

2 MATLAB Help on meshgrid

MESHGRID X and Y arrays for 3-D plots.

`[X,Y] = MESHGRID(x,y)` transforms the domain specified by vectors `x` and `y` into arrays X and Y that can be used for the evaluation of functions of two variables and 3-D surface plots.

The rows of the output array X are copies of the vector `x` and the columns of the output array Y are copies of the vector `y`.

`[X,Y] = MESHGRID(x)` is an abbreviation for `[X,Y] = MESHGRID(x,x)`.

`[X,Y,Z] = MESHGRID(x,y,z)` produces 3-D arrays that can be used to evaluate functions of three variables and 3-D volumetric plots.

For example, to evaluate the function $x \cdot \exp(-x^2 - y^2)$ over the range $-2 < x < 2$, $-2 < y < 2$,

```
[X,Y] = meshgrid(-2:.2:2, -2:.2:2);
Z = X .* exp(-X.^2 - Y.^2);
surf(X,Y,Z)
```

MESHGRID is like NDGRID except that the order of the first two input and output arguments are switched (i.e., `[X,Y,Z] = MESHGRID(x,y,z)` produces the same result as `[Y,X,Z] = NDGRID(y,x,z)`). Because of this, MESHGRID is better suited to problems in cartesian space, while NDGRID is better suited to N-D problems that aren't spatially based. MESHGRID is also limited to 2-D or 3-D.

Class support for inputs X,Y,Z:

float: double, single

See also `surf`, `slice`, `ndgrid`.