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 sinisoid $f(x, y) = x \sin(xy)$ 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).
```

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```
[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*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.
```