Spring 2004 Math 253/501–503
Surface Graphics
Wed, 31/Mar ©2004, Art Belmonte

Summary

hvsd

My routine **hvsd** ("**H**orizontally or **V**ertically **S**imple **D**ata") is principally designed to create rectangular coordinate data that is used to graph surfaces. It allows for both rectangluar and non-rectangular parameter regions; e.g., regions that are rectangular, triangular, bounded by curves, etc. Type "**help hvsd**" in the MATLAB Command Window for exhaustive details. That said, you'll probably find the examples in this handout much easier to understand (because they're shorter).

The **hvsd** routine provides a way to produce surface graphics that is both easier to use and more general than **qsurf**.

Like many of the routines I've written, **hvsd** can be pushed beyond its design specs to do some pretty unusual graphics. More on this later.

Parametric surfaces

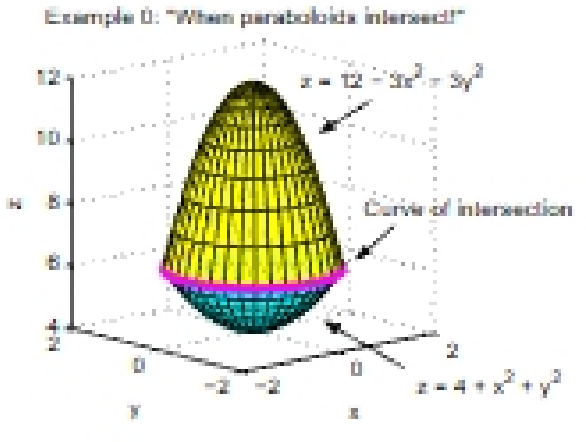
Cooper does a good job in Section 6.4 of *A MATLAB Companion for Multivariable Calculus* in explaining how to graph parametric surfaces using MATLAB. I'll give several examples from our lecture handouts that show the actual code used to produce the graphics.

MATLAB Examples

0. The "need-to-know" example for Exam 3

At the end of class on Tuesday, 30/Mar, we graphed intersecting circular paraboloids and found the volume between them. For your benefit, we kick the party off by replicating this example.

Find the volume of the solid bounded below by the circular paraboloid $z = 4 + x^2 + y^2$ and above by the circular paraboloid $z = 12 - 3x^2 - 3y^2$.



Solution

When the paraboloids intersect, their z-coordinates are equal.

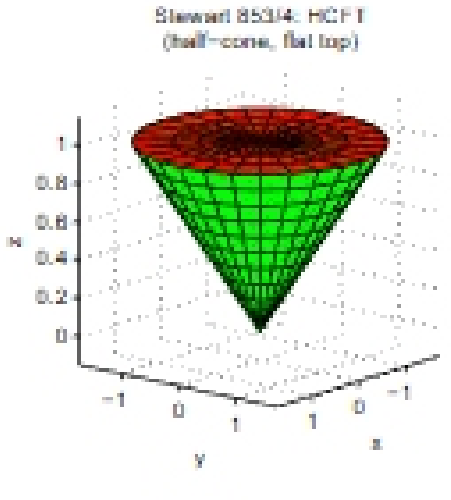
$$\begin{aligned} 4 + x^2 + y^2 &= 12 - 3x^2 - 3y^2 \\ 4x^2 + 4y^2 &= 8 \\ 4r^2 &= 8 \\ r^2 &= 2 \\ r &= \pm\sqrt{2};\ \text{pick } \sqrt{2}. \end{aligned}$$

Using cylindrical coordinates, we saw in class that the volume is

$$V = \iiint_E 1\, dV = \int_0^{2\pi} \int_0^{\sqrt{2}} \int_{4+r^2}^{12-3r^2} 1 \cdot r\, dz\, dr\, d\theta = 8\pi \approx 25.13\ \text{cm}^3.$$

As shown in class, here is the code that produced the plot.

By default, a standard multicolor color map ("jet") is used. You may alternatively specify a solid color. As you saw in Example Zero, this is useful when you have separate faces that you'd like to distinguish. (These are called surface "patches.") Here are two codes that produced the respective plots.


Stewart 853/4: HCFT
(half-cone, flat top)
z
1
0.8
0.6
0.4
0.2
0
−1
0
1
y
1
0
−1
x