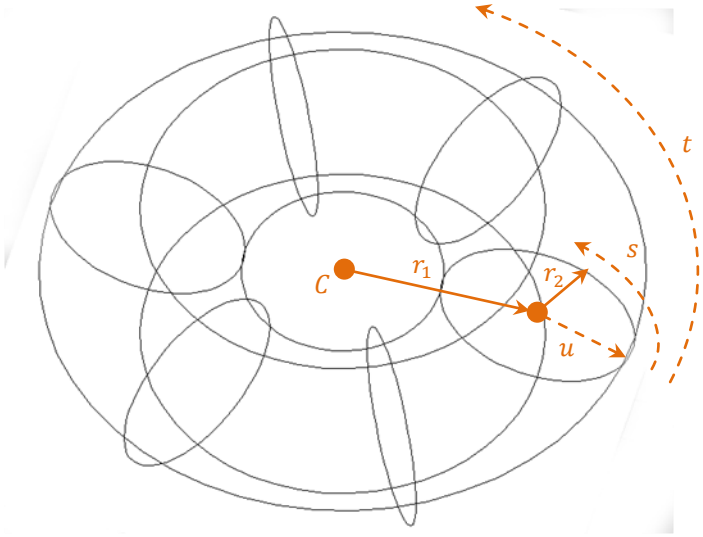
Parametric Torus (Volume)

A parametric torus surface can be defined by a center point C, a radius r_1 from the center of the torus to the center of the circular cross-section, a radius r_2 from the center of the cross-section to the surface, and two parameters s and t.



The parametric torus equation is the parametric circle equation applied in the x-z plane with an offset from the center of the object.

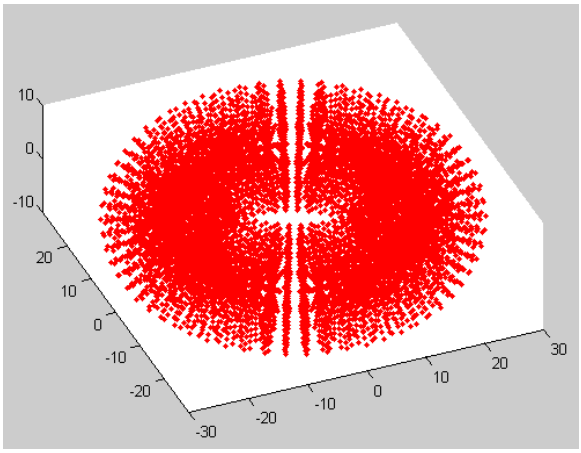
$$x_T = r_1 + u \cdot r_2 \cdot \cos(2\pi \cdot s)$$
$$y_T = 0$$
$$z_T = u \cdot r_2 \cdot \sin(2\pi \cdot s)$$

The circle is then revolved around z-axis about the center point C

$$x = x_C + \cos(2\pi \cdot t) \cdot x_T + \sin(2\pi \cdot t) \cdot y_T$$
$$y = y_C - \sin(2\pi \cdot t) \cdot x_T + \cos(2\pi \cdot t) \cdot y_T$$
$$z = z_C + z_T$$

Expanding the algebra gives:

$$x = x_C + \cos(2\pi \cdot t) \cdot (r_1 + u \cdot r_2 \cdot \cos(2\pi \cdot s))$$
$$y = y_C - \sin(2\pi \cdot t) \cdot (r_1 + u \cdot r_2 \cdot \cos(2\pi \cdot s))$$
$$z = z_C + u \cdot r_2 \cdot \sin(2\pi \cdot s)$$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