

# About Snail Shell Surfaces

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These snail-like surfaces are included for their entertaining shapes; try making one of your own.

Note that a snail is constructed as a one-parameter family of curves  $C(u)$ , depending on one of the surface parameter  $u$ , where the curve  $C(u)$  projects onto the circle of radius  $r := s(aa + bb \cos(u))$  about the origin in the  $x, z$ -plane; in fact it is given parametrically by:

$$x := r \cos(vv)$$

$$z := r \sin(vv)$$

$$y := dd(1 - s) + s bb \sin(u)$$

where the variable  $vv$  parameterizing  $C(u)$  is given in terms of the second surface parameter  $v$  by

$$vv := v + (v + ee)^2/16.$$

The variable  $s$  is a function of  $v$  and the parameters  $cc$  and  $ee$ :

$$s := \exp(-cc vv).$$

It scales the diameter of the opening of  $C(u)$ , while the parameter  $dd$  stretches in the  $z$ -direction. (The snail may not close nicely at the top after parameter changes. The quadratic term

in the definition of  $vv$  can be used to close the snail if one also adjusts  $v_{\max}$  by experiment.)

The parameter  $ee$  controls the size of the opening—the default is  $ee = -2$ .

Make only small changes to  $cc$ , and keep  $bb \geq aa$ .