Program name
coordinates_of_2dimentional_radial_spline_control_points

Program overview

This program calculates the z and r coordinates of the radial spline control points in the radial plane.

Input parameters
Integer Radial distance from z axis to boundary between the ellipse and the inside vortex
Integer Height of the toroid.
Integer radius of whole toroid

Output Parameters
Height of point at boundary
Radial gradient of point at boundary.
Height of control point P2

Shape to rotate about the z axis to form the extremity of Pim’s toroid.

z(r) = + SQRT(((1 - ((r-10750)^2)/10750^2))*9770^2)

$$z(r) = \sqrt{(1 - (\frac{(r-10750)^2}{10750^2}) * 9770^2}$$

let

$$u = \frac{r}{10750} - 1$$

So that

$$z(u) = (1 - u^2)^{\frac{1}{2}} * 9770$$

$$\frac{dz}{du} = \frac{9770}{2}(1 - u^2) * (-2u)$$

$$\frac{dz}{du} = -9770 * u * (1 - u^2)$$

$$\frac{du}{dr} = \frac{1}{10750}$$

By the chain rule

$$\frac{dz}{dr} = \frac{dz}{du}\frac{du}{dr}$$

$\frac{dz}{dr} = -\frac{9770}{10750} * \left(\frac{r}{10750} - 1\right)$*(1-($\frac{r}{10750} - 1)^{2}$)

Solved at the boundary between the ellipse and the inside vortex, r = 9750mm

$$\frac{dz}{dr} = 0.083811418$$

No units as it is a 2D spatial slope. (some hand written calculations in lab book 8618/90289.5=0.95448, I assume/recall from sketchup suggests that this is an accurate result, now can compute a Real to the maximum number of decimal places as the language compiler storage will allow.

This looks like it will match the sketchup model reading. I am not checking sketchup for the sake of it, I am finding position and gradient parameters for the vortex 2D equation to later nest into the 3D spiral helix equation.

Find the height of the ellipse at this boundary, i.e. the 2D coordinates of P3

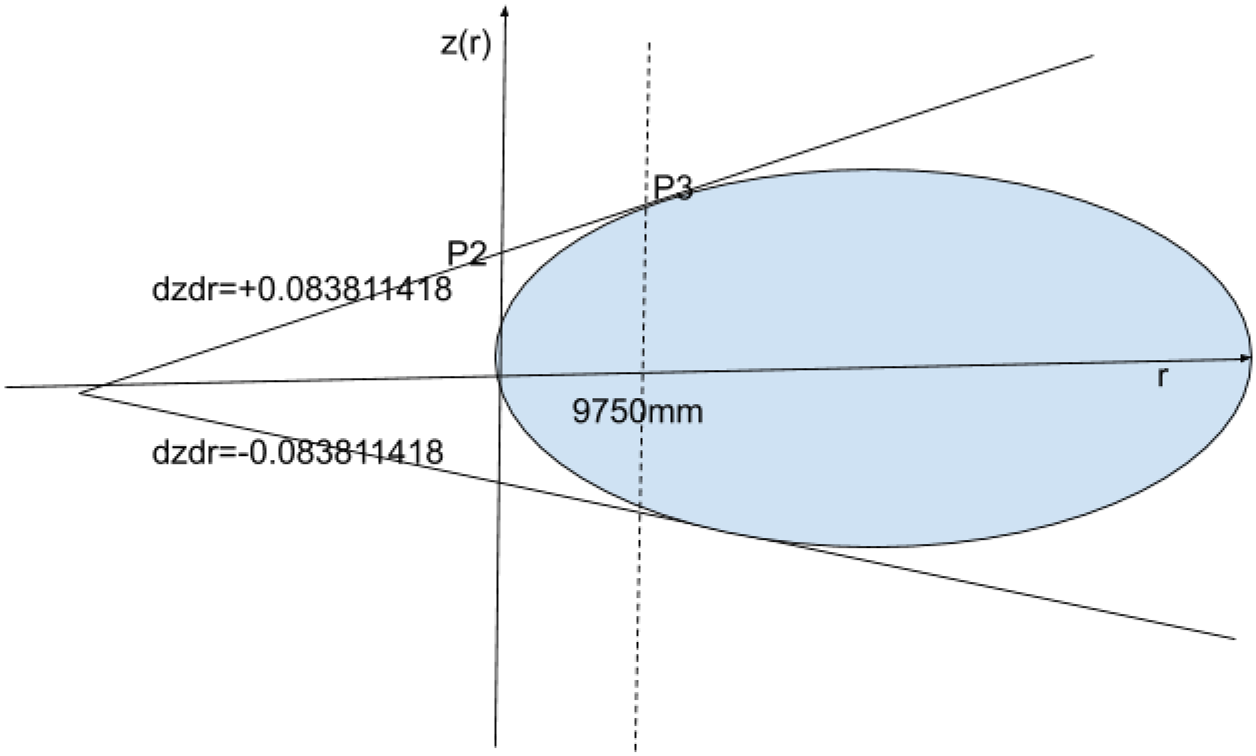
Sub r=9750mm into the equation for z(r)

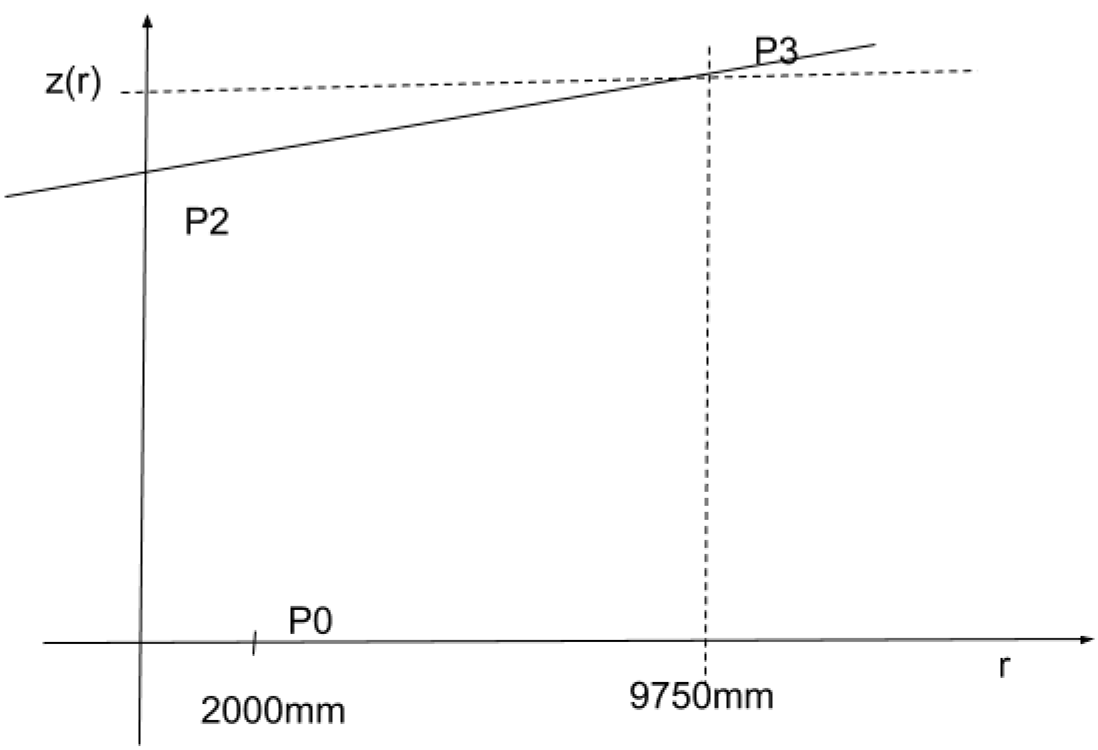
$$z(r) = \sqrt{\left(1 - \left(\frac{(r-10750)^2}{10750^{\,2}}\right) * 9770^{\,2}\right.}$$

z(9750mm)=9728mm

P3=(9750mm,9728mm)

Now I have the point and the gradient at that point, which leads to the spline, or the parabola, or higher order polynomials. First try the spline.


z(r)
P3
P2
dzdr=+0.083811418
r
9750mm
dzdr=-0.083811418


z(r)
P3
P2
P0
r
9750mm
2000mm

End