BarleyCorn Edge Math

by Bill Ooms

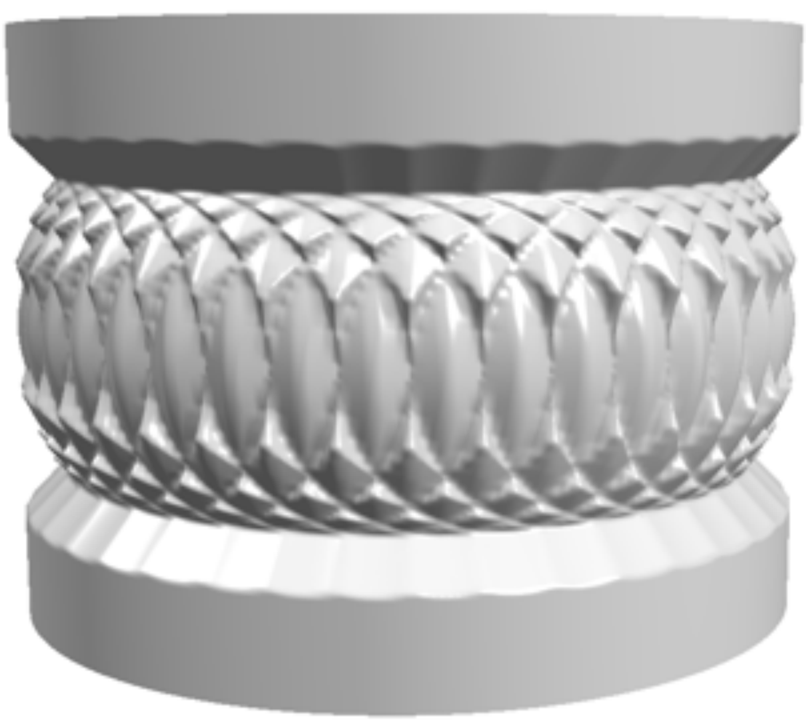
This is for barleycorns on the edge of a cylinder. The math details are on the next two pages for those who are interested. It's easiest to just use a spreadsheet.

Barleycorns on the edge of a cylinder are difficult to do because you can't line up the edge of one cut with that of another cut on the surface of the cylinder. If you do, then as you go deeper the cuts will no longer be coincident.

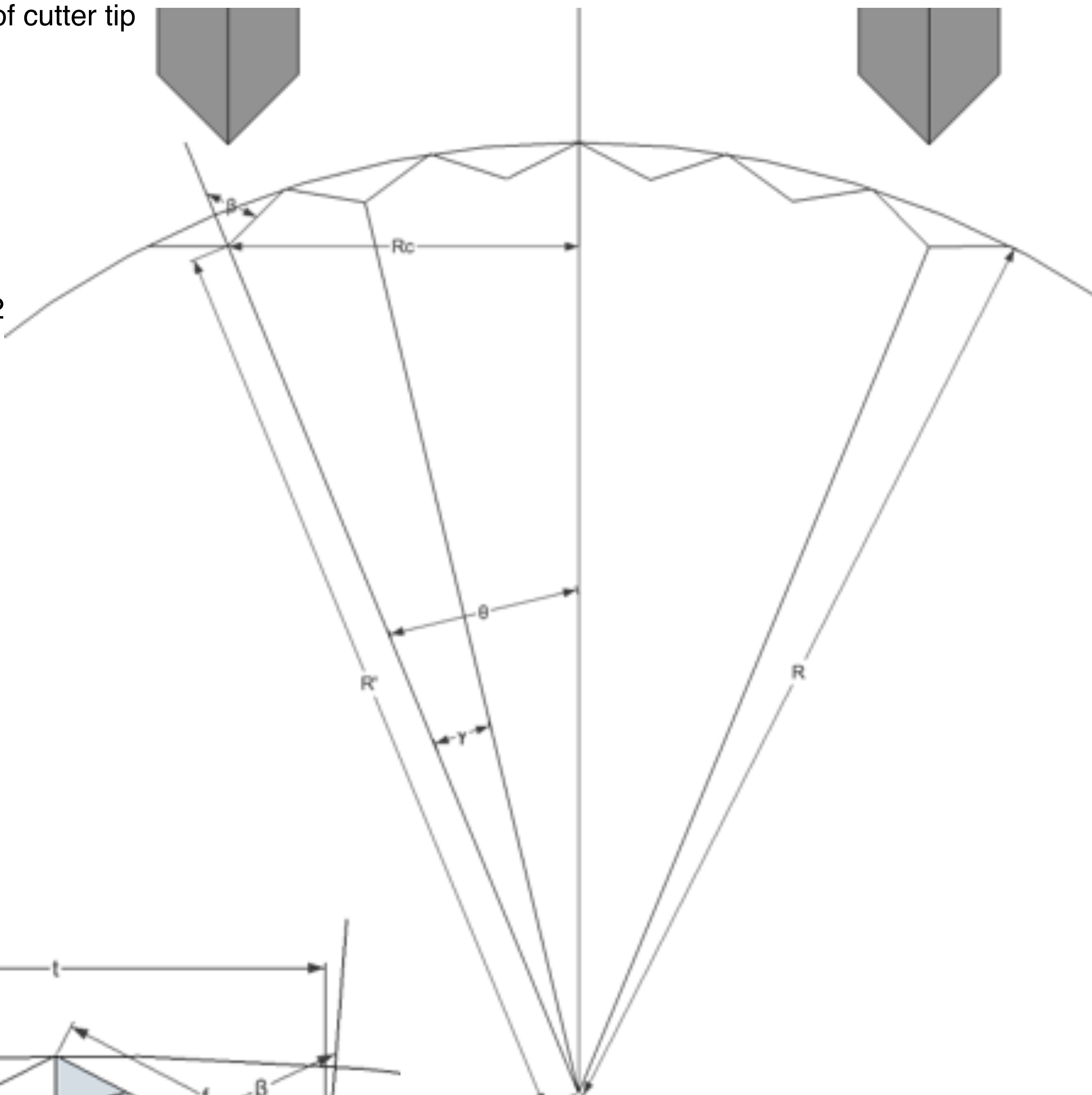
A typical situation is that you know the approximate width of the band (i.e. the diameter circle cut by the ECF), and want a certain visual appearance based on the number of barleycorns within each cut circle. Vary the number of circles to be cut until the outer radius is slightly less than your actual cylinder radius. You can also make slight adjustments to the ECF radius.

For example, consider a cutter angle of 90 degrees, the width of the band about 0.5" (which is the diameter of each cut circle, so Rc=0.25), 5 barleycorns within each cut circle (M=5) and 40 cuts around the circumference (an index wheel with 40 positions). Using the spreadsheet you find that this gives an outer radius of 0.677" (cylinder diameter of 1.354).

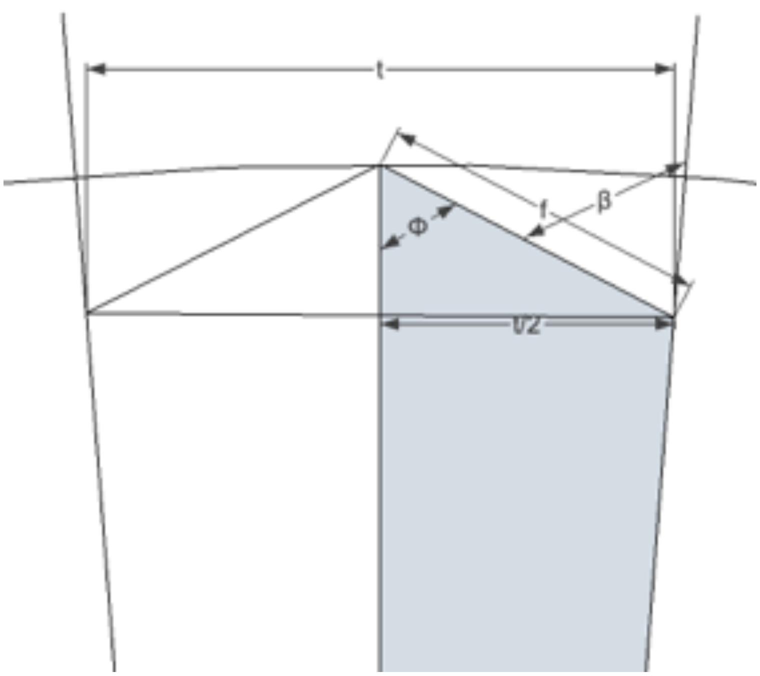
The depth of cut required to create a smooth round bead is 0.048" while rotating the work slowly. Then you'll cut an additional 0.026" while indexing for the actual barleycorns.



R = Radius of the cylinder
Rc = Radius of eccentric cutter (half the diameter of the cut circle)
N = total number of barleycorns (number of cuts, positions on index wheel)
M = number of barleycorns within each circle
angle α = angle of cutter tip

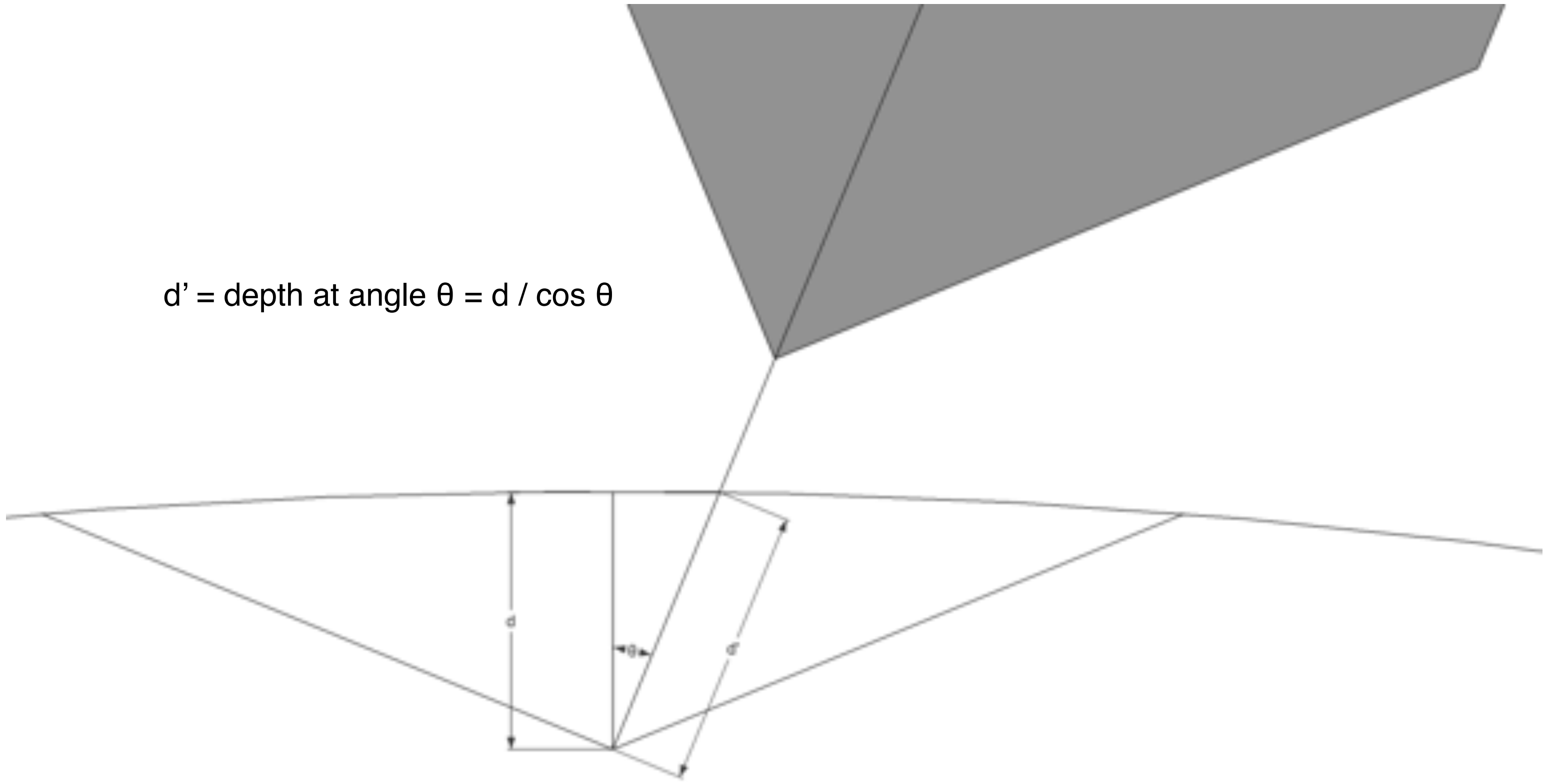


angle $\gamma = 360/N$
angle $\theta = \gamma * M/2$
$R' = Rc / \sin \theta$
angle $\beta = \theta + \alpha/2$



t = bottom width $\approx 2\pi * R' / N$
angle $\phi = \beta - \gamma/2$
f = face of barleycorn $= t / (2 * \sin \phi)$
$R = \sqrt{(f^2 + R'^2 + 2 * f * R' * \cos \beta)}$
d = vertical cut depth $= R - R'$

d’ = depth at angle θ = d / cos θ



D = depth of cut for a smooth bead = R - √(R² - Rc²)