An Involute Gear's Profile

Figures 1 to 7 show the steps to create the involute gear profile with MATLAB files. The addendum circle is shown in Figure 1, and the involute potion is shown in Figure 2. The involute curve is modeled based on the tooth thickness t at any radius r of an involute gear [1]:

$$t = 2 \times r \times \left| \frac{t_p}{2 \times r_p} + \left(\tan\phi_p - \phi_p\right) - \left(\tan\phi - \phi\right) \right|$$

where $\phi = \cos^{-1}\frac{r_b}{r}$

$t_p = \frac{\pi \times D}{2 \times N}$ and $r_p = \frac{D}{2}$ are t and r at pitch circle respectively, and D and N are pitch diameter and the number of teeth respectively.

When $r < r_b$, the radius of base circle, the tooth profile is non-involute and is represented by a straight line segment, as shown in Figure 3. Figure 4 shows the fillet, and Figure 5 shows the dedendum circle. Figure6 shows a one-half tooth incorporating Figures 1 to 5. Figure 7 is a complete tooth by reflecting and copying the one-half tooth about the line of symmetry. The tooth is then rotated and copied to generate the whole gear, as shown in Figure 8.

Working Model is a motion simulation software package that cannot model a part with a hole. Therefore, to model an internal gear, the profile generated with MATLAB has a small slit, as shown in Figures 8 and 9.

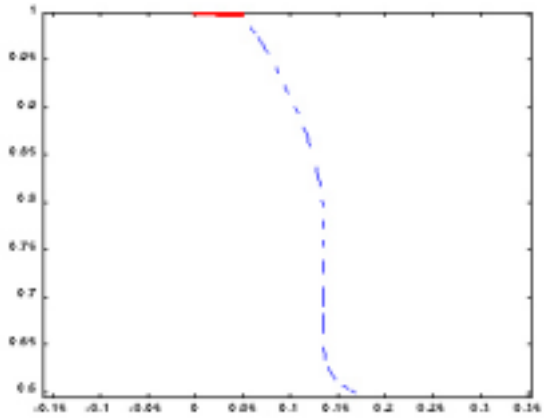

Figure 1 Addendum Circle

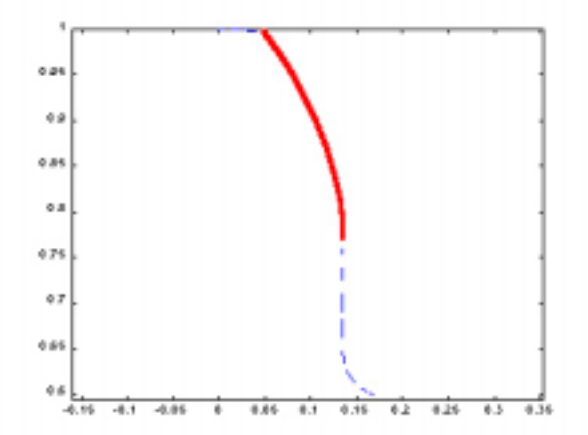

Figure 2 Involute Portion

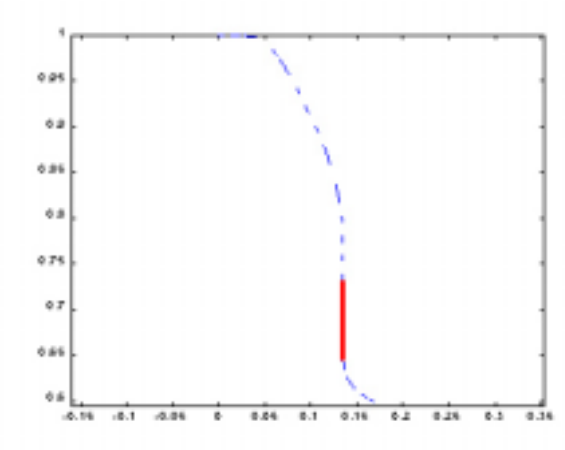

Figure 3 Non-involute Portion

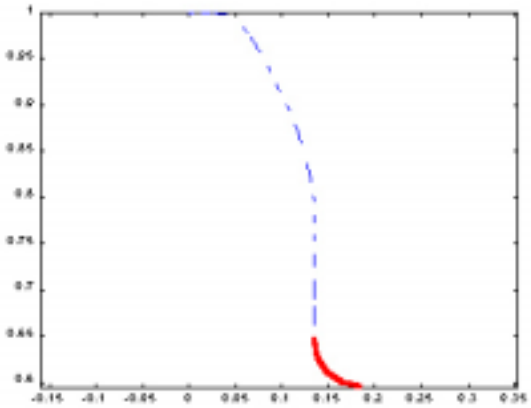

Figure 4 Fillet

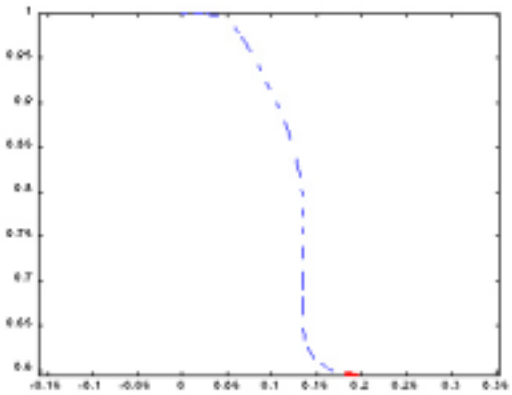

Figure 5 Dedendum Circle

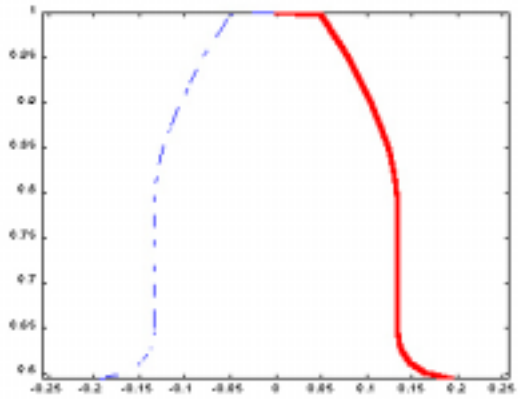

Figure 6 One-half tooth

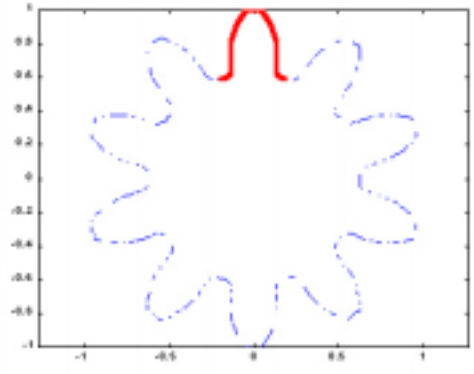

Figure 7 One tooth

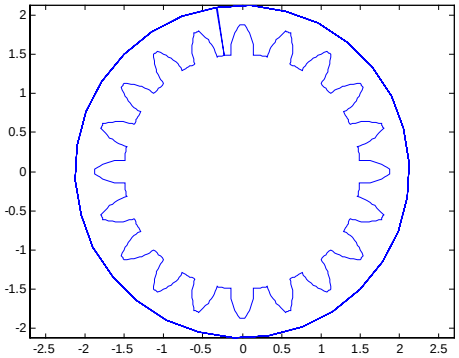

Figure 8 An internal Gear

References

1. Shigley, J. E. and Uicker, J.J., *Theory of Machines and Mechanisms*, McGraw-Hill, 1986.