Interference (干涉) and Undercutting (過切)

Stub Teeth

- Interference can be prevented by ensuring the addendum circle of either gear does not intersect the line of action beyond the interference points.

\[
AD = c \sin \delta = O_2O_3 \sin \delta
\]

where \( \delta \) is the pressure angle

\[
O_2D = \sqrt{r_{b2}^2 + (c \sin \delta)^2}
\]

Noninterference condition for gear 2

\[
r_2 + a_2 \leq r_{b2} + (c \sin \delta)^2 = r_{a2} \text{ (max)}
\]

Noninterference condition for gear 3

\[
r_3 + a_3 \leq O_3A = \sqrt{r_{b3}^2 + (c \sin \delta)^2} = r_{a3} \text{ (max)}
\]
Interference (干涉) and Undercutting (過切)

Effect of the Pressure Angle

➤ A larger pressure angle decreases the diameter of the base circle and thus increases the involute portion of the tooth profile.

➤ But larger pressure angles increase shaft loading.

Noninterference condition for larger gear

\[
r_{a_2}^{\text{max}} = \sqrt{r_{b_2}^2 + (c \sin \delta)^2}
\]

\[
r_{a_2}^2(\text{max}) = r_{b_2}^2 + (c \sin \delta)^2
\]

\[\therefore r_{b_2} = r_2 \cos \delta\]

\[\Rightarrow r_{a_2}^2(\text{max}) = r_2^2 \cos^2 \delta + (c \sin \delta)^2\]
Interference （干涉） and Undercutting （過切）

Effect of the Pressure Angle

\[ r_{a_2}^2 \text{ (max)} = r_2^2 \cos^2 \delta + (c \sin \delta)^2 \]

\[ r_{a_2}^2 \text{ (max)} = r_2^2 \left(1 - \sin^2 \delta\right) + (c \sin \delta)^2 \]

\[ = r_2^2 + (c^2 - r_2^2) \sin^2 \delta \]

\[ \Rightarrow \sin \delta = \sqrt{\frac{r_{a_2}^2 \text{ (max)} - r_2^2}{c^2 - r_2^2}} \]

By using standard addendum

\[ \sin \delta_{\text{min}} = \sqrt{\frac{r_{a_2}^2 - r_2^2}{c^2 - r_2^2}} \]