

# Definition of profile and flank line modifications in KISSsoft

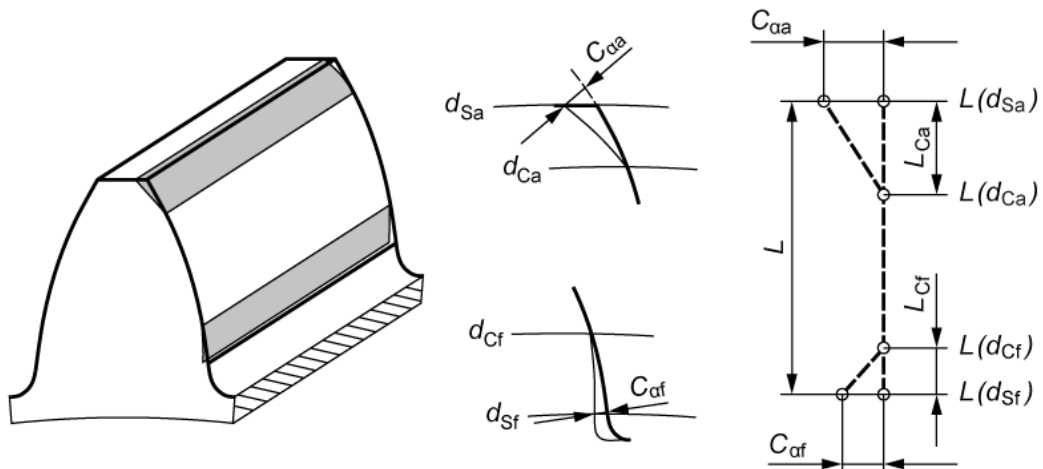
5.11.2020, for 2021 release

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# 1 Tip and root relief, linear

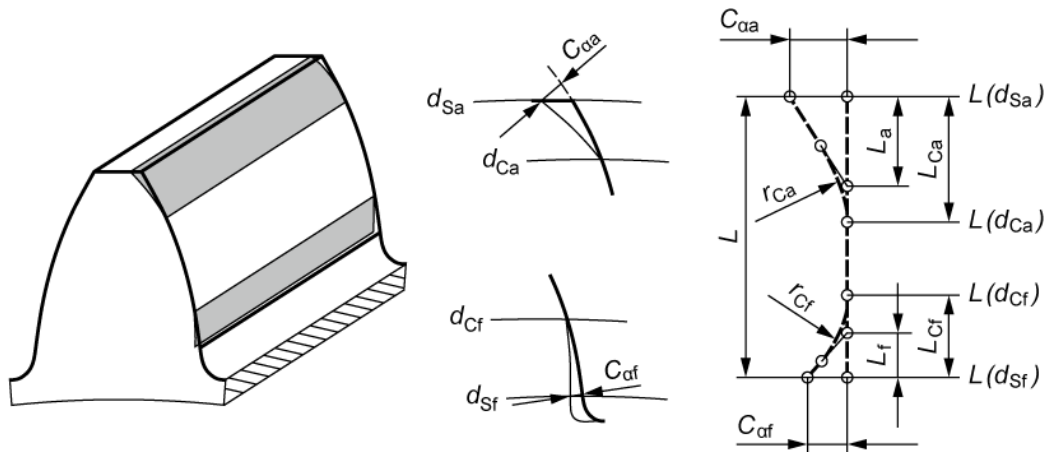
Picture: **Mod\_tipRootReliefLinear.png**



|                                                                                                 |                                       |                |                                        |
|-------------------------------------------------------------------------------------------------|---------------------------------------|----------------|----------------------------------------|
| $d_{Sa}$                                                                                        | tip relief, start, at tip             | $d_{Sf}$       | root relief, start, at root            |
| $d_{Ca}$                                                                                        | tip relief, end, at tip               | $d_{Cf}$       | root relief, end, at root              |
| $C_{\alpha a}$                                                                                  | tip relief, value, normal to involute | $C_{\alpha f}$ | root relief, value, normal to involute |
| $L_{Ca}$                                                                                        | tip relief, roll length               | $L_{Cf}$       | root relief, roll length               |
| $L$                                                                                             | roll length                           |                |                                        |
| <u>Inputs:</u> Value = $C_{\alpha a}$ , $C_{\alpha f}$   Factor 1 = $L_{Ca}/m_n$ , $L_{Cf}/m_n$ |                                       |                |                                        |
| <u>Conditions:</u> Value $\neq 0$   Factor 1 $> 0$                                              |                                       |                |                                        |

## 2 Tip and root relief, linear with transition radius

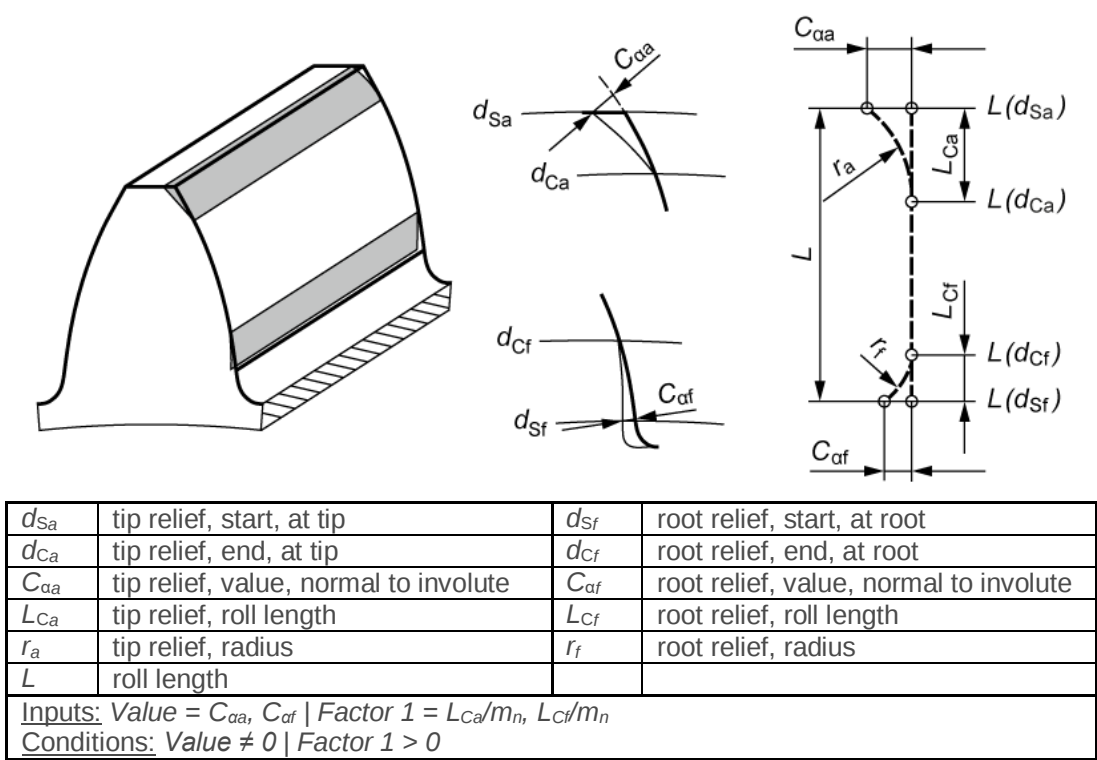
Picture: **Mod\_tipRootReliefRad.png**



|                                                                                                                                                                                            |                                       |          |                                        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|----------|----------------------------------------|
| $d_{Sa}$                                                                                                                                                                                   | tip relief, start, at tip             | $d_{Sf}$ | root relief, start, at root            |
| $d_{Ca}$                                                                                                                                                                                   | tip relief, end, at tip               | $d_{Cf}$ | root relief, end, at root              |
| $C_{aa}$                                                                                                                                                                                   | tip relief, value, normal to involute | $C_{af}$ | root relief, value, normal to involute |
| $L_{Ca}$                                                                                                                                                                                   | tip relief, roll length               | $L_{Cf}$ | root relief, roll length               |
| $r_{Ca}$                                                                                                                                                                                   | transition radius, at tip             | $r_{Cf}$ | transition radius, at root             |
| $L$                                                                                                                                                                                        | roll length                           |          |                                        |
| <u>Inputs:</u> Value = $C_{aa}$ , $C_{af}$   Factor 1 = $L_{Ca}/m_n$ , $L_{Cf}/m_n$   Factor 2 = $r_{Ca}/m_n$ , $r_{Cf}/m_n$<br><u>Conditions:</u> Value > 0   Factor 1 > 0   Factor 2 > 0 |                                       |          |                                        |

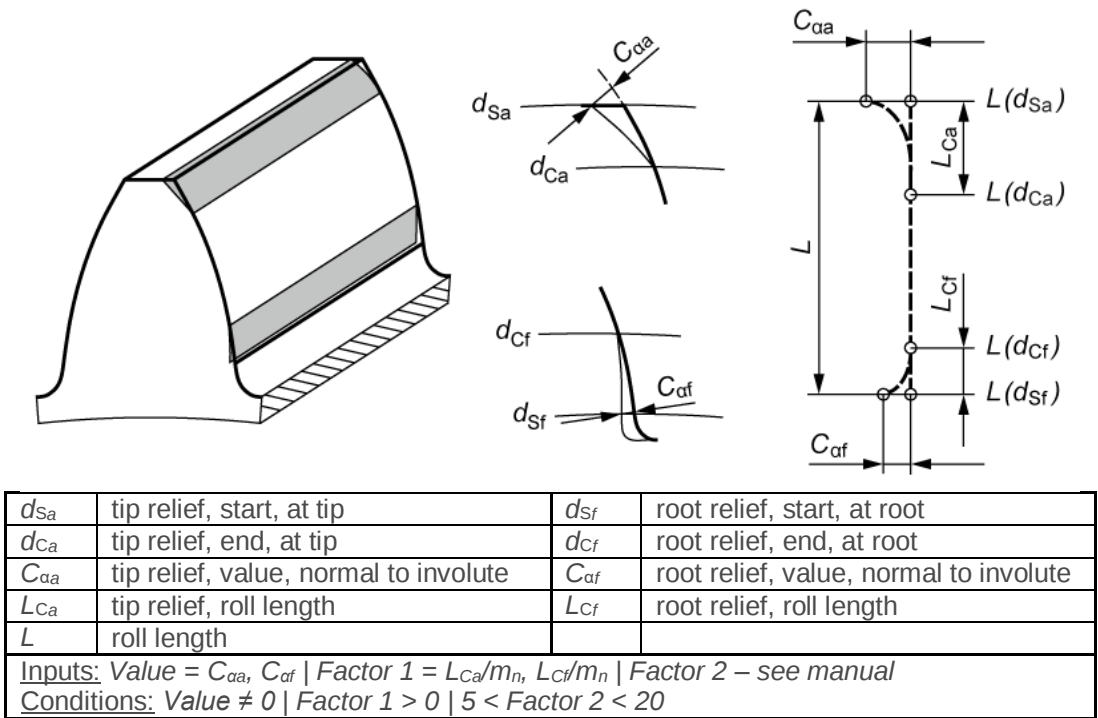
### 3 Tip and root relief, arc like

Picture: **Mod\_tipRootReliefArc.png**



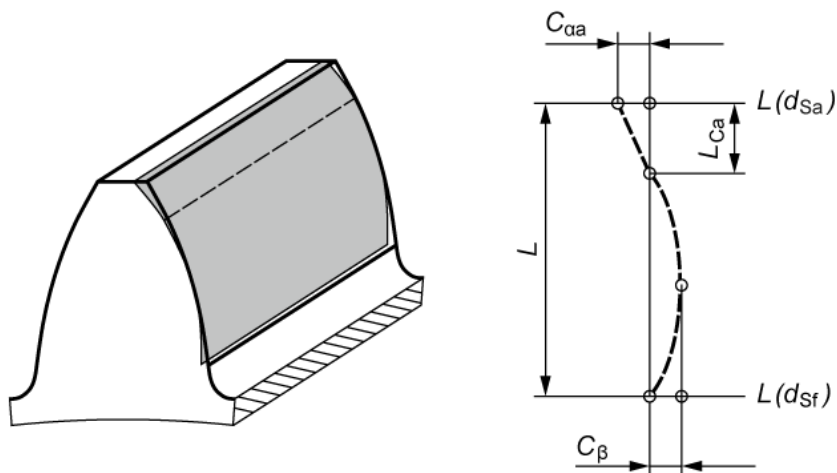
# 4 Tip and root relief, progressive

Picture: **Mod\_tipRootReliefProg.png**



## 5 Tip relief, linear with profile crowning

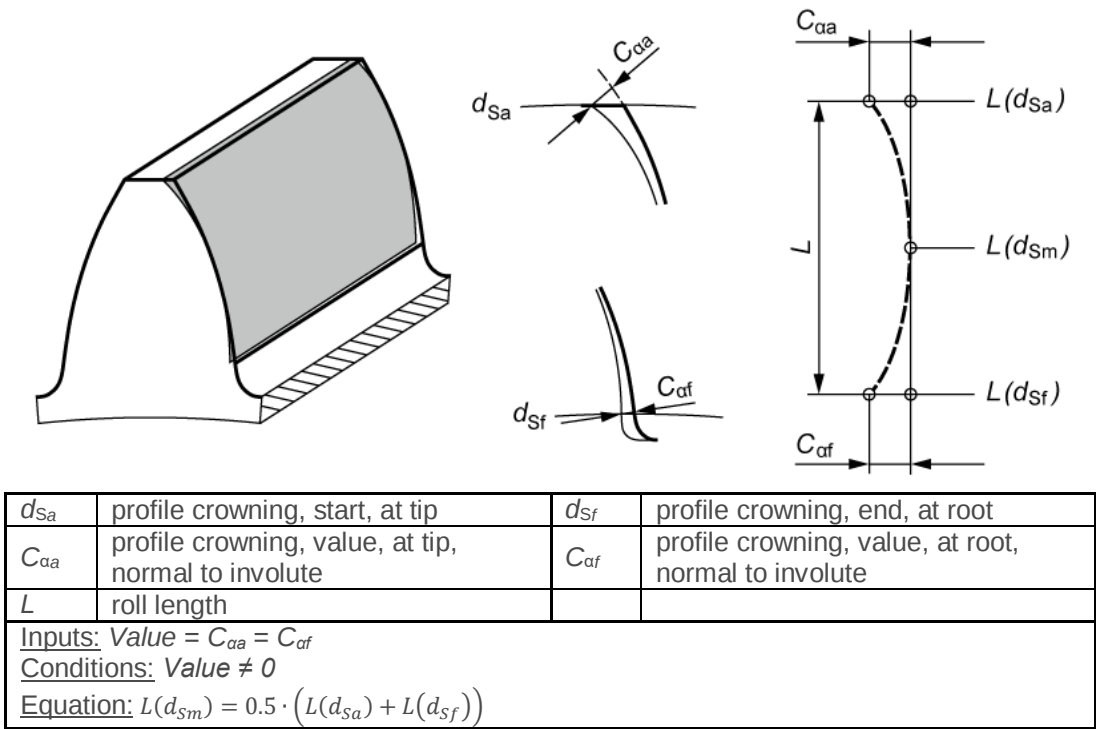
Picture: **Mod\_tipReliefCrown.png**



|                                                                                                           |                                       |          |                            |
|-----------------------------------------------------------------------------------------------------------|---------------------------------------|----------|----------------------------|
| $d_{sa}$                                                                                                  | modification, start, at tip           | $d_{sf}$ | modification, end, at root |
| $C_{\alpha a}$                                                                                            | tip relief, value, normal to involute | $L_{Ca}$ | tip relief, roll length    |
| $C_{\beta}$                                                                                               | profile crowning, value               | $L$      | roll length                |
| <u>Inputs:</u> Value = $C_{\beta}$   Factor 1 = $L_{Ca}/m_n$   Factor 2 = $1000 \cdot C_{\alpha a} / m_n$ |                                       |          |                            |
| <u>Conditions:</u> Value $\neq 0$   Factor 1 $> 0$   Factor 2 $> 0$                                       |                                       |          |                            |

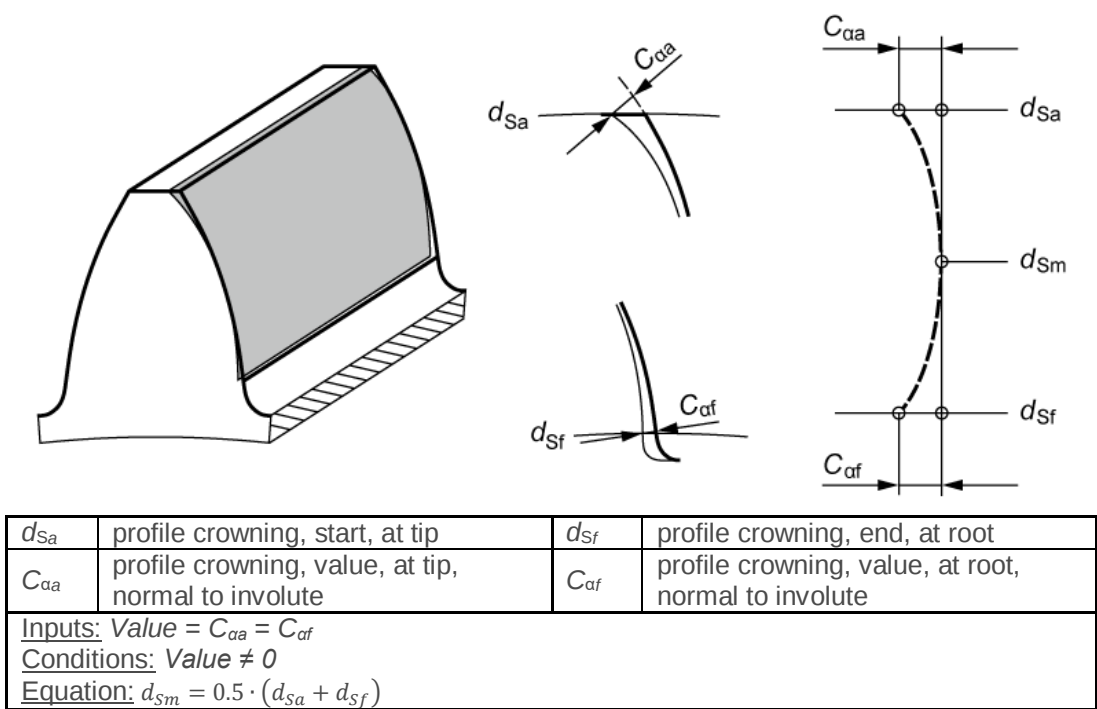
# 6 Profile crowning (roll length-centered)

Picture: **Mod\_profileCrowning.png**



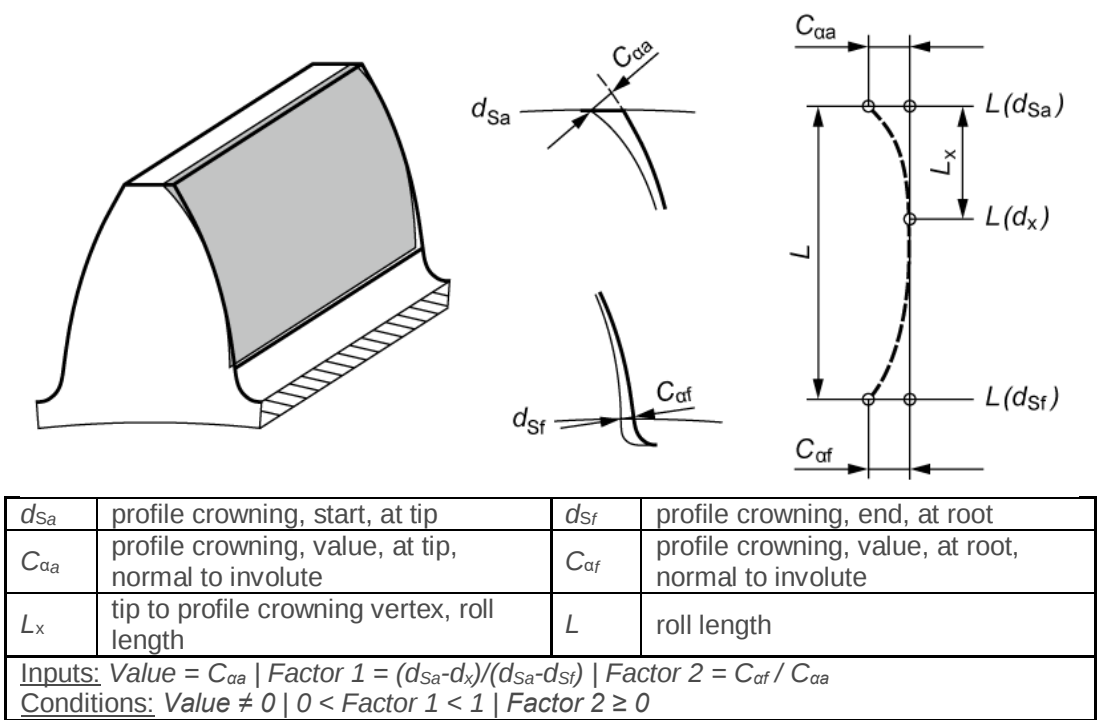
# 7 Profile crowning (diameter-centered)

Picture: Mod\_profileCrowningDia.png



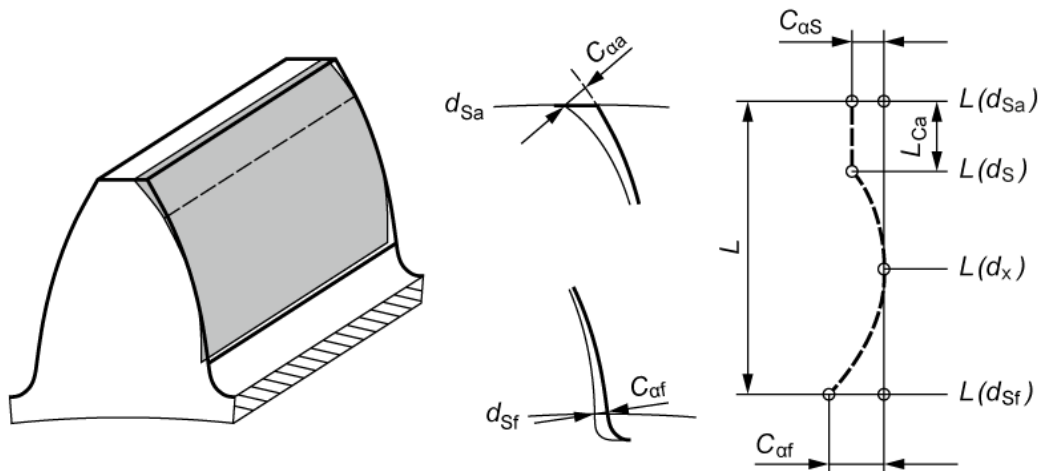
# 8 Profile crowning, eccentric

Picture: **Mod\_profileCrowningExc.png**



## 9 Profile crowning, shortened

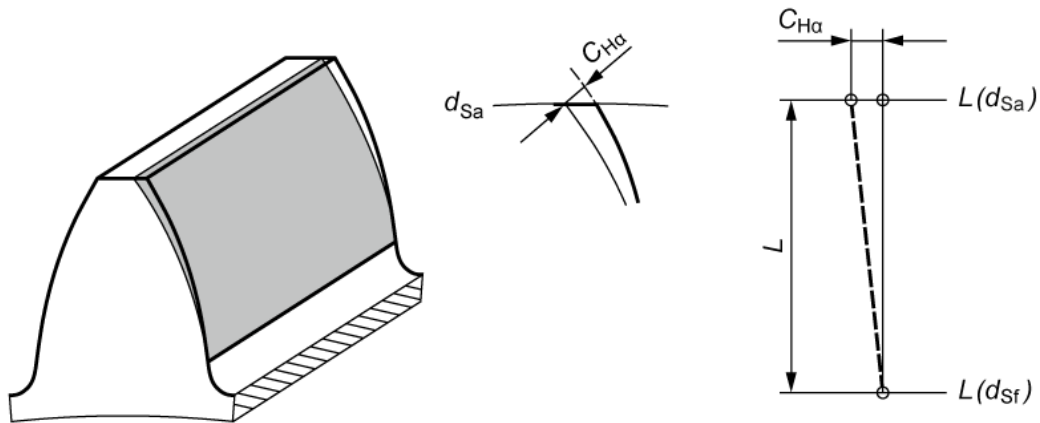
Picture: **Mod\_profileCrowningShort.png**



|                                                                                                                                                                                                                      |                                                      |          |                                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|----------|--------------------------------------------|
| $d_{Sa}$                                                                                                                                                                                                             | modification, start, at tip                          | $d_{Sf}$ | modification, start, at root               |
| $C_{af}$                                                                                                                                                                                                             | profile crowning, value, at root, normal to involute | $L_{Ca}$ | tip to profile crowning start, roll length |
| $L_x$                                                                                                                                                                                                                | tip to profile crowning vertex, roll length          | $L$      | roll length                                |
| <u>Inputs:</u> Value = $C_{af}$   Factor 1 = $(d_{Sa}-d_x)/(d_{Sa}-d_{Sf})$   Factor 2 = $(d_{Sa}-d_S)/(d_{Sa}-d_{Sf})$<br><u>Conditions:</u> Value $\neq 0$   $0 < \text{Factor 1} < 1$   $0 < \text{Factor 2} < 1$ |                                                      |          |                                            |

## 10 Pressure angle modification (value), Transverse profile slope modification (value)

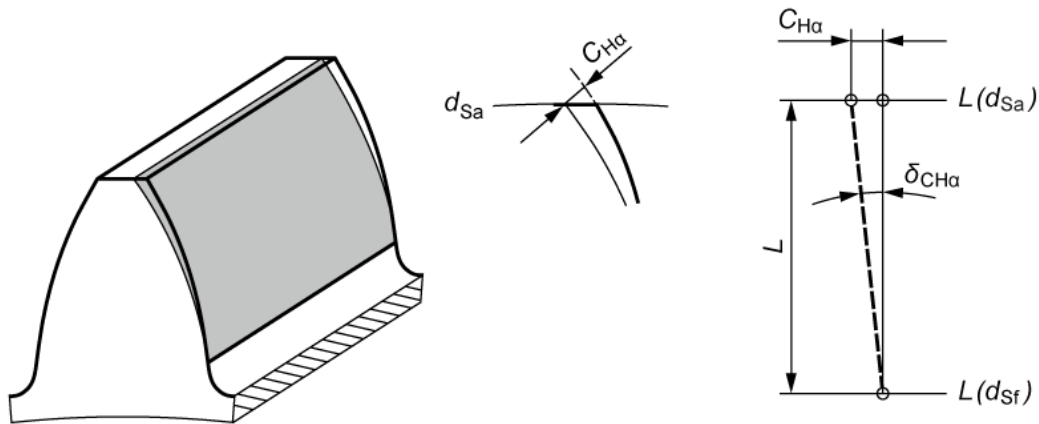
Picture: **Mod\_pressureAngle.png**



|                                                                                                                                                                                                                                                                                |                                                                  |          |                                                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|----------|-----------------------------------------------------|
| $d_{Sa}$                                                                                                                                                                                                                                                                       | transverse profile slope modification, start, at tip             | $d_{Sf}$ | transverse profile slope modification, end, at root |
| $C_{H\alpha}$                                                                                                                                                                                                                                                                  | transverse profile slope modification, value, normal to involute | $L$      | roll length                                         |
| $\alpha_{n\,eff}$                                                                                                                                                                                                                                                              | effective pressure angle                                         |          |                                                     |
| <u>Inputs:</u> Value = $C_{H\alpha}$<br><u>Conditions:</u> Value $\neq 0$<br><u>Equation:</u> $\alpha_{n\,eff} = \text{atan}\left(\cos(\beta) \cdot \tan\left(\alpha_t + 0.001 \cdot C_{H\alpha} / \text{Abs}\left(L(d_{Sa}) - L(d_{Sf})\right) / \tan \alpha_t\right)\right)$ |                                                                  |          |                                                     |

## 11 Pressure angle modification (angle), Transverse profile slope modification (angle),

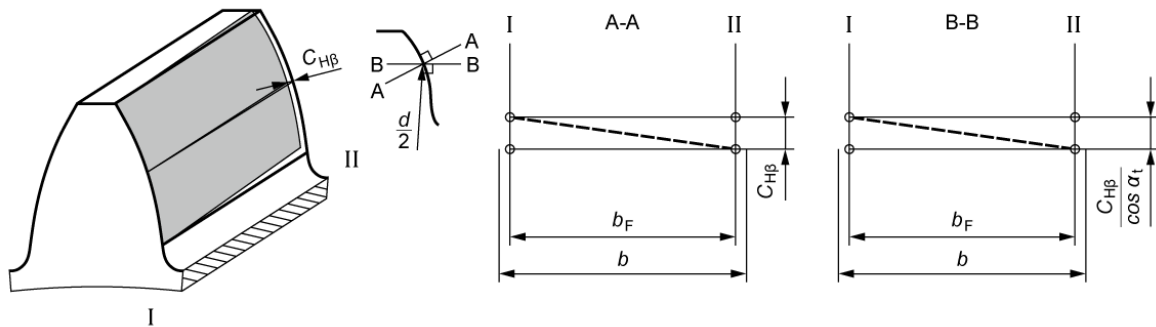
Picture: Mod\_pressureAngleAng.png



|                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                  |                     |                                                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|---------------------|-----------------------------------------------------|
| $d_{Sa}$                                                                                                                                                                                                                                                                                                                                                                                                                                                     | transverse profile slope modification, start, at tip             | $d_{Sf}$            | transverse profile slope modification, end, at root |
| $C_{H\alpha}$                                                                                                                                                                                                                                                                                                                                                                                                                                                | transverse profile slope modification, value, normal to involute | $\delta_{CH\alpha}$ | transverse profile slope modification, value, angle |
| $L$                                                                                                                                                                                                                                                                                                                                                                                                                                                          | roll length                                                      | $\alpha_{n\,eff}$   | effective pressure angle                            |
| <p><u>Inputs:</u> Factor 1 = <math>\delta_{CH\alpha}</math> (in arc minutes)</p> <p><u>Conditions:</u> Factor 1 <math>\neq 0</math></p> <p><u>Equation:</u> <math>C_{H\alpha} = 1000 \cdot \tan \alpha_t \cdot (Factor\ 1 / 60 / \cos \beta) \cdot Abs((d_{Sa}) - L(d_{Sf}))</math></p> <p><u>Equation:</u> <math>\alpha_{n\,eff} = atan(\cos(\beta) \cdot \tan(\alpha_t + 0.001 \cdot C_{H\alpha} / Abs(L(d_{Sa}) - L(d_{Sf}))) / \tan \alpha_t)</math></p> |                                                                  |                     |                                                     |

## 12 Helix angle modification, tapered or conical

Picture: **Mod\_helixAngleCon.png**

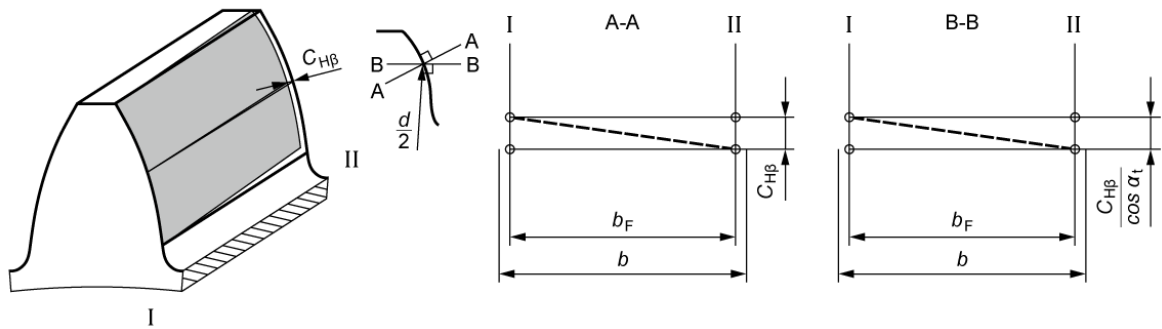


| Spur | Right helix | Left helix |
|------|-------------|------------|
|      |             |            |

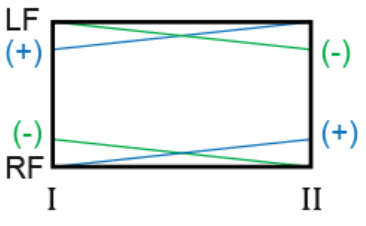
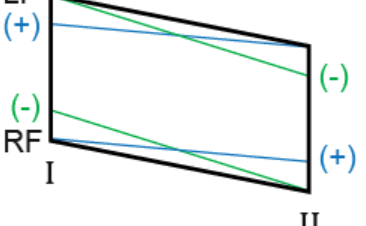
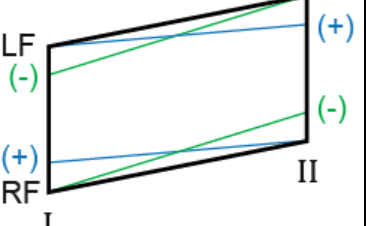
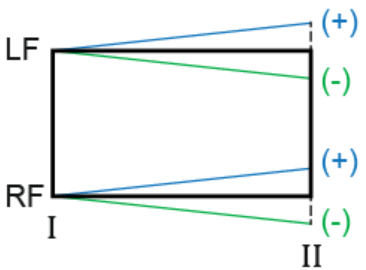
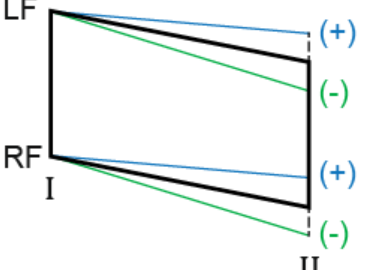
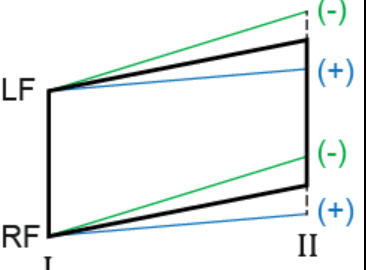
|                                                                                                                                                                                                                                                                                                                                                                                |                                 |               |                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|---------------|-----------------------|
| $b$                                                                                                                                                                                                                                                                                                                                                                            | facewidth                       | $b_F$         | effective facewidth   |
| $C_{H\beta}$                                                                                                                                                                                                                                                                                                                                                                   | helix angle modification, value | $\beta_{eff}$ | effective helix angle |
| <p>Inputs: Value = <math>C_{H\beta}</math></p> <p>Conditions: Value <math>\neq 0</math></p> <p>Equation: <math>C_{H\beta} = 1000 \cdot \cos \alpha_n \cdot b_F \cdot (\tan(\beta - \text{Factor } 1/60) - \tan(\beta))</math></p> <p>Equation: <math>\beta_{eff} = \text{atan}((b_F \cdot \tan \beta \pm \text{Abs}(0.001 \cdot C_{H\beta} / \cos \alpha_t)) / b_F)</math></p> |                                 |               |                       |

# 13 Helix angle modification, parallel (value)

Picture: Mod\_helixAngle.png



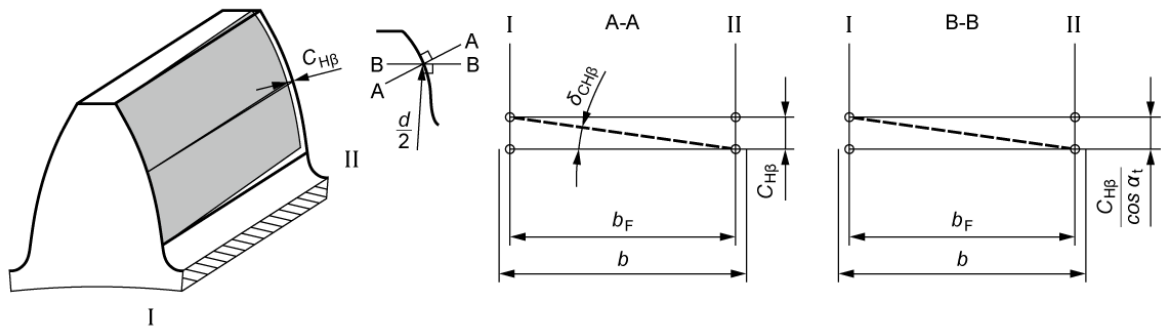
|                                      |                                        | Spur                             | Right helix                      | Left helix                       |
|--------------------------------------|----------------------------------------|----------------------------------|----------------------------------|----------------------------------|
| ISO 21771                            | Remove material on both sides          | LF (+) (-)<br>RF (-) (+)<br>I II | LF (+) (-)<br>RF (-) (+)<br>I II | LF (+) (-)<br>RF (-) (+)<br>I II |
|                                      | Manufactured with modified helix angle | LF (+) (-)<br>RF (-) (+)<br>I II | LF (+) (-)<br>RF (-) (+)<br>I II | LF (+) (-)<br>RF (-) (+)<br>I II |
| ISO 1328, external gears ( $z > 0$ ) | Remove material on both sides          | LF (-) (+)<br>RF (+) (-)<br>I II | LF (-) (+)<br>RF (+) (-)<br>I II | LF (+) (-)<br>RF (-) (+)<br>I II |
|                                      | Manufactured with modified helix angle | LF (-) (+)<br>RF (+) (-)<br>I II | LF (-) (+)<br>RF (+) (-)<br>I II | LF (+) (-)<br>RF (-) (+)<br>I II |

|                                      |                                        |                                                                                   |                                                                                    |                                                                                     |
|--------------------------------------|----------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| ISO 1328, internal gears ( $z < 0$ ) | Remove material on both sides          |  |  |  |
|                                      | Manufactured with modified helix angle |  |  |  |

|                                                                                                                                                                                                                                                                                                                                                                                                       |                                 |               |                       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|---------------|-----------------------|
| $b$                                                                                                                                                                                                                                                                                                                                                                                                   | facewidth                       | $b_F$         | effective facewidth   |
| $C_{H\beta}$                                                                                                                                                                                                                                                                                                                                                                                          | helix angle modification, value | $\beta_{eff}$ | effective helix angle |
| <u>Inputs:</u> $Value = C_{H\beta}$<br><u>Conditions:</u> $Value \neq 0$<br><u>Equation:</u> $C_{H\beta} = 1000 \cdot \cos \alpha_n \cdot b_F \cdot (\tan(\beta - Factor\ 1/60) - \tan(\beta))$<br><u>Equation:</u> $\beta_{eff} = atan((b_F \cdot \tan \beta \pm Abs(0.001 \cdot C_{H\beta} / \cos \alpha_t)) / b_F)$<br>More information in Instruction 117: Definition of helix angle modification |                                 |               |                       |

# 14 Helix angle modification, parallel (angle)

Picture: Mod\_helixAngleAng.png



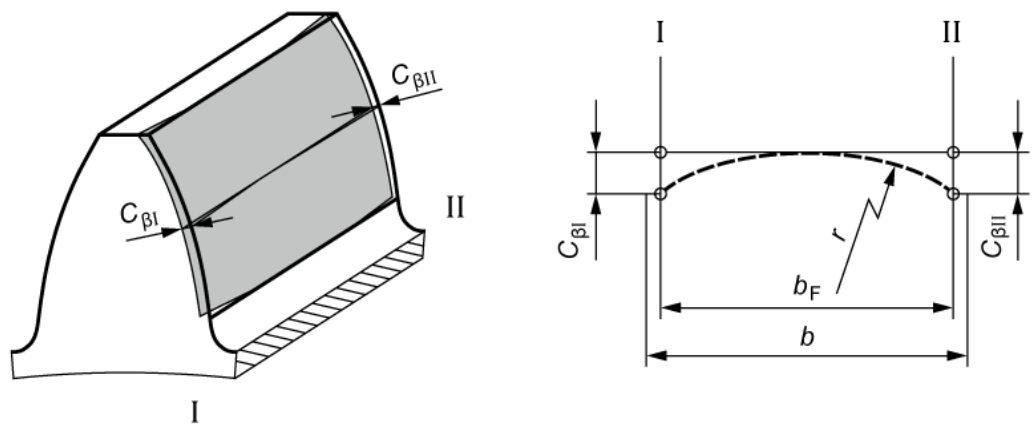
|                                      |                                        | Spur | Right helix | Left helix |
|--------------------------------------|----------------------------------------|------|-------------|------------|
| ISO 21771                            | Remove material on both sides          |      |             |            |
|                                      | Manufactured with modified helix angle |      |             |            |
| ISO 1328, external gears ( $z > 0$ ) | Remove material on both sides          |      |             |            |
|                                      | Manufactured with modified helix angle |      |             |            |

|                                      |                                        |  |  |  |
|--------------------------------------|----------------------------------------|--|--|--|
| ISO 1328, internal gears ( $z < 0$ ) | Remove material on both sides          |  |  |  |
|                                      | Manufactured with modified helix angle |  |  |  |

|                                                                                                                                                                                                                                                                  |                                 |                    |                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|--------------------|----------------------------------------|
| $b$                                                                                                                                                                                                                                                              | facewidth                       | $b_F$              | effective facewidth                    |
| $C_{H\beta}$                                                                                                                                                                                                                                                     | helix angle modification, value | $\delta_{CH\beta}$ | helix angle modification, value, angle |
| $\beta_{eff}$                                                                                                                                                                                                                                                    | effective helix angle           |                    |                                        |
| <u>Inputs:</u> Factor 1 = $\delta_{CH\beta}$ (in arc minutes)<br><u>Conditions:</u> Factor 1 $\neq 0$<br><u>Equation:</u> $\beta_{eff} = \text{atan}\left(\left(b_F \cdot \tan \beta \pm \text{Abs}(0.001 \cdot C_{H\beta} / \cos \alpha_t)\right) / b_F\right)$ |                                 |                    |                                        |

# 15 Flank line crowning

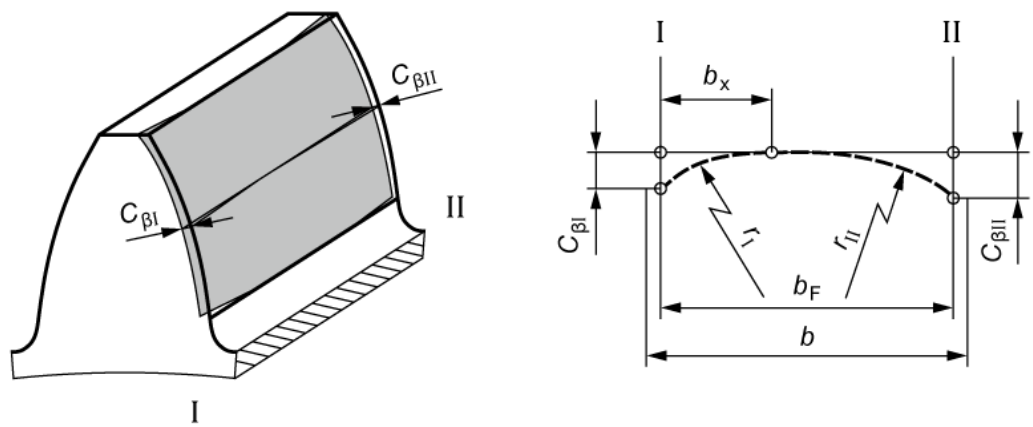
Picture: Mod\_flankCrowning.png



|                                              |                                       |                |                                        |
|----------------------------------------------|---------------------------------------|----------------|----------------------------------------|
| $b$                                          | facewidth                             | $b_F$          | effective facewidth                    |
| $C_{\beta I}$                                | flank line crowning, value, at side I | $C_{\beta II}$ | flank line crowning, value, at side II |
| $r$                                          | flank line crowning, radius           |                |                                        |
| Inputs: Value = $C_{\beta I} = C_{\beta II}$ |                                       |                |                                        |
| Conditions: Value $\neq 0$                   |                                       |                |                                        |

# 16 Flank line crowning, eccentric

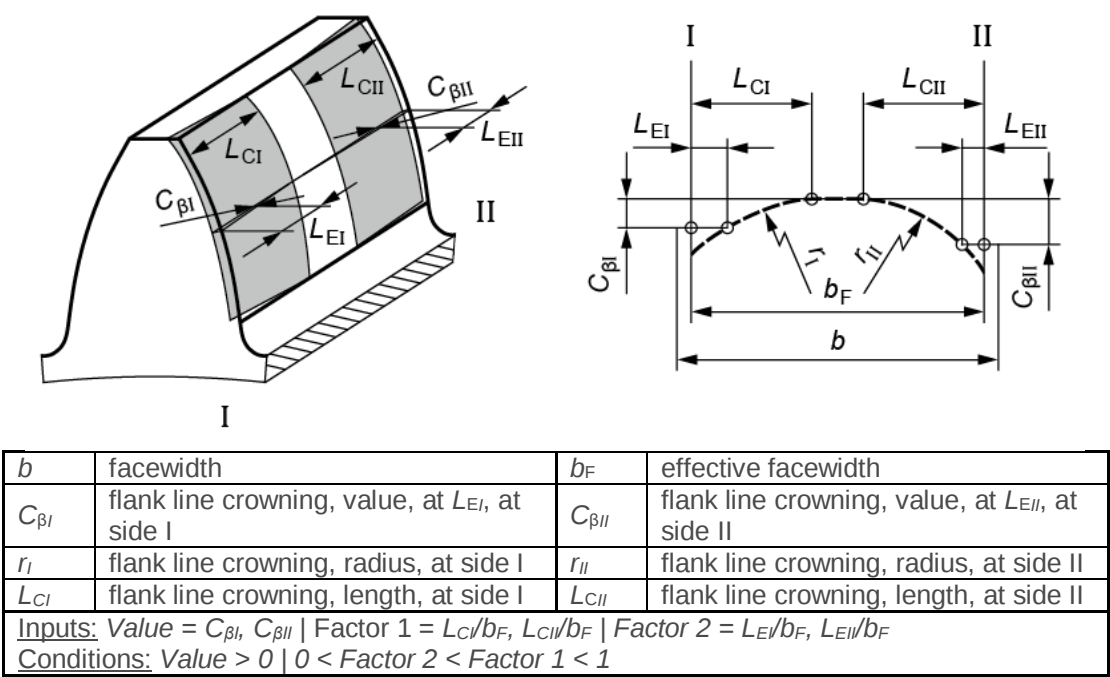
Picture: **Mod\_flankCrowningExc.png**



|                                                                                              |                                        |                |                                         |
|----------------------------------------------------------------------------------------------|----------------------------------------|----------------|-----------------------------------------|
| $b$                                                                                          | facewidth                              | $b_F$          | effective facewidth                     |
| $C_{\beta I}$                                                                                | flank line crowning, value, at side I  | $C_{\beta II}$ | flank line crowning, value, at side II  |
| $r_I$                                                                                        | flank line crowning, radius, at side I | $r_{II}$       | flank line crowning, radius, at side II |
| $b_x$                                                                                        | side I to crowning vertex, length      |                |                                         |
| Inputs: Value = $C_{\beta I}$   Factor 1 = $b_x/b_F$   Factor 2 = $C_{\beta II}/C_{\beta I}$ |                                        |                |                                         |
| Conditions: Value $\neq 0$   $0 < \text{Factor 1} < 1$   Factor 2 $> 0$                      |                                        |                |                                         |

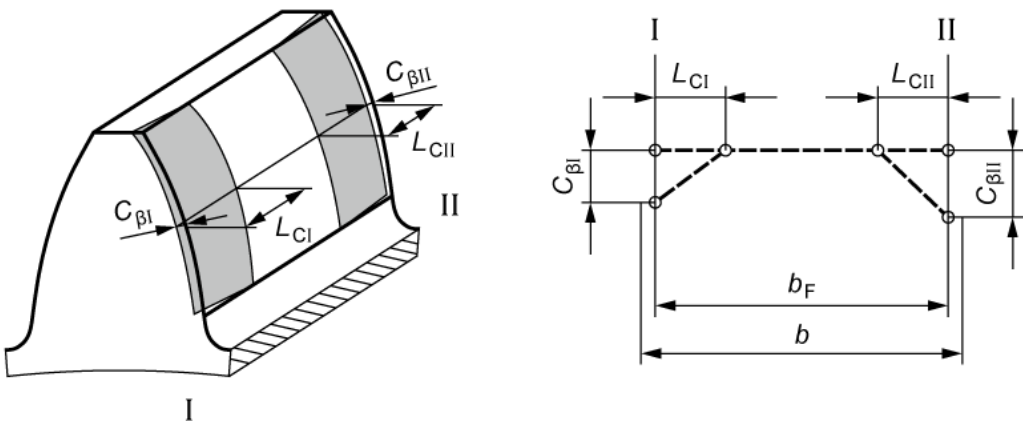
# 17 Flank line crowning, side I and II

Picture: **Mod\_flankCrowningShort.png**



# 18 End relief, linear, side I and II

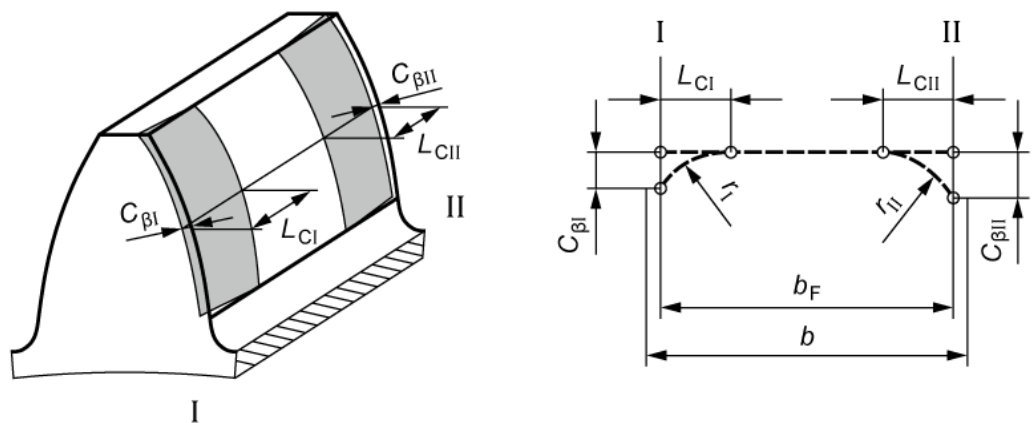
Picture: **Mod\_endRelief.png**



|                                                                                                                                      |                               |                |                                |
|--------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|----------------|--------------------------------|
| $b$                                                                                                                                  | facewidth                     | $b_F$          | effective facewidth            |
| $C_{\beta I}$                                                                                                                        | end relief, value, at side I  | $C_{\beta II}$ | end relief, value, at side II  |
| $L_{CI}$                                                                                                                             | end relief, length, at side I | $L_{CII}$      | end relief, length, at side II |
| Inputs: Value = $C_{\beta I}$ , $C_{\beta II}$   Factor 1 = $L_{CI}/b_F$ , $L_{CII}/b_F$<br>Conditions: Value > 0   0 < Factor 1 < 1 |                               |                |                                |

# 19 End relief, arc-like, side I and II

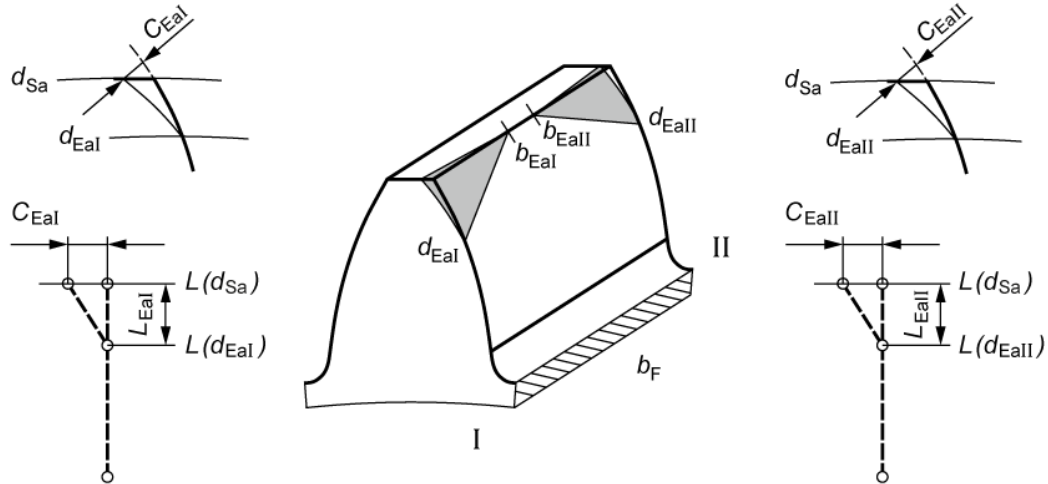
Picture: **Mod\_endReliefArc.png**



|                                                                                          |                               |                |                                |
|------------------------------------------------------------------------------------------|-------------------------------|----------------|--------------------------------|
| $b$                                                                                      | facewidth                     | $b_F$          | effective facewidth            |
| $C_{\beta I}$                                                                            | end relief, value, at side I  | $C_{\beta II}$ | end relief, value, at side II  |
| $r_I$                                                                                    | end relief, radius, at side I | $r_{II}$       | end relief, radius, at side II |
| $L_{CI}$                                                                                 | end relief, length, at side I | $L_{CII}$      | end relief, length, at side II |
| Inputs: Value = $C_{\beta I}$ , $C_{\beta II}$   Factor 1 = $L_{CI}/b_F$ , $L_{CII}/b_F$ |                               |                |                                |
| Conditions: Value > 0   0 < Factor 1 < 1                                                 |                               |                |                                |

## 20 Triangular tip relief, side I and II

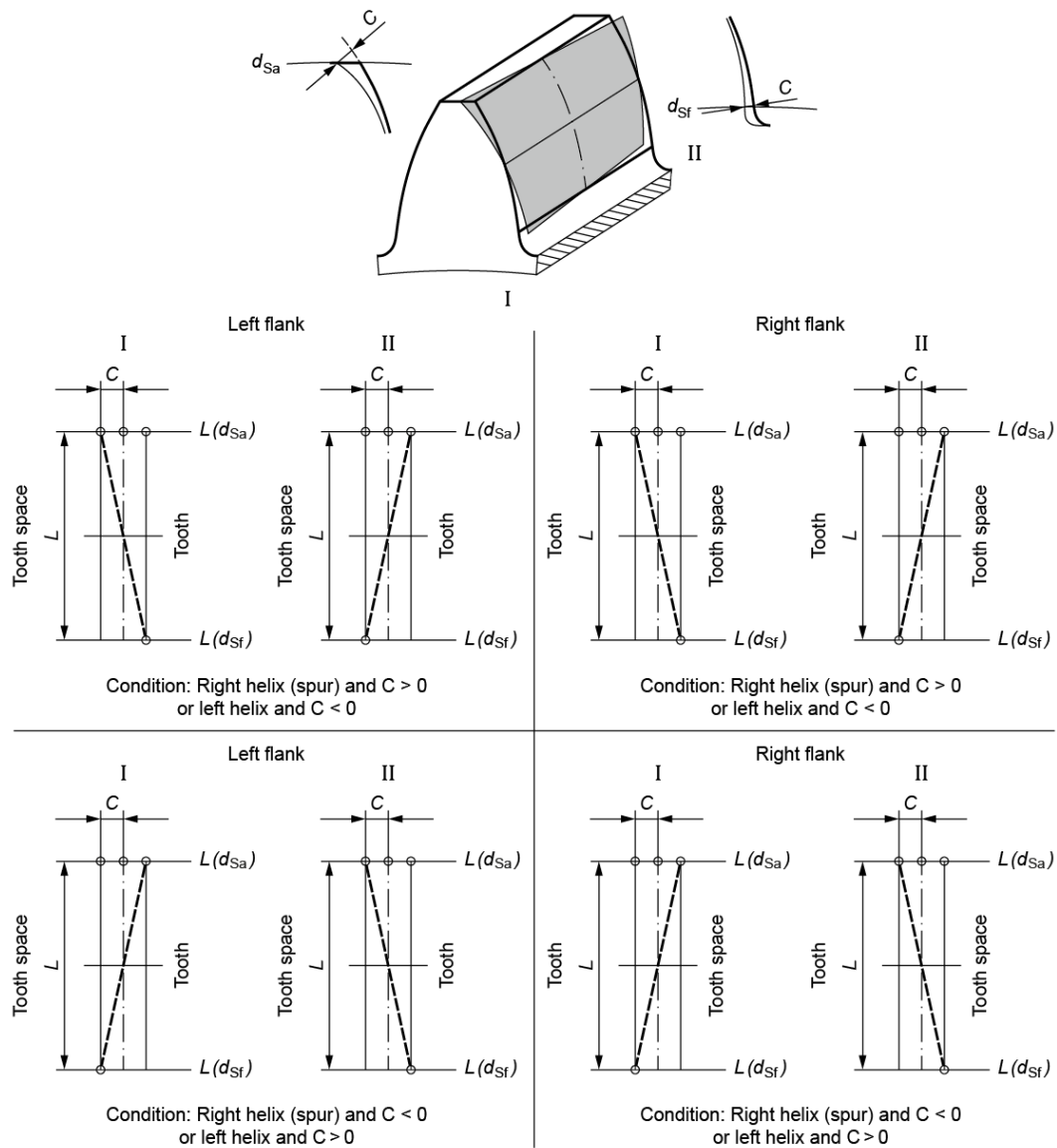
Picture: **Mod\_triangularRelief.png**



|                                                                                                                                                                                                         |                                      |            |                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|------------|---------------------------------------|
| $b$                                                                                                                                                                                                     | facewidth                            | $b_F$      | effective facewidth                   |
| $d_{Sa}$                                                                                                                                                                                                | triangular relief, start, at side I  | $d_{Sa}$   | triangular relief, start, at side II  |
| $d_{EaI}$                                                                                                                                                                                               | triangular relief, end, at side I    | $d_{EaII}$ | triangular relief, end, at side II    |
| $C_{EaI}$                                                                                                                                                                                               | triangular relief, value, at side I  | $C_{EaII}$ | triangular relief, value, at side II  |
| $b_{EaI}$                                                                                                                                                                                               | triangular relief, length, at side I | $b_{EaII}$ | triangular relief, length, at side II |
| <u>Inputs:</u> Value = $C_{EaI}$ , $C_{EaII}$   Factor 1 = $L_{EaI}/m_n$ , $L_{EaII}/m_n$   Factor 2 = $b_{EaI}/b_F$ , $b_{EaII}/b_F$<br><u>Conditions:</u> Value > 0   Factor 1 > 0   0 < Factor 2 < 1 |                                      |            |                                       |

## 21 Twist

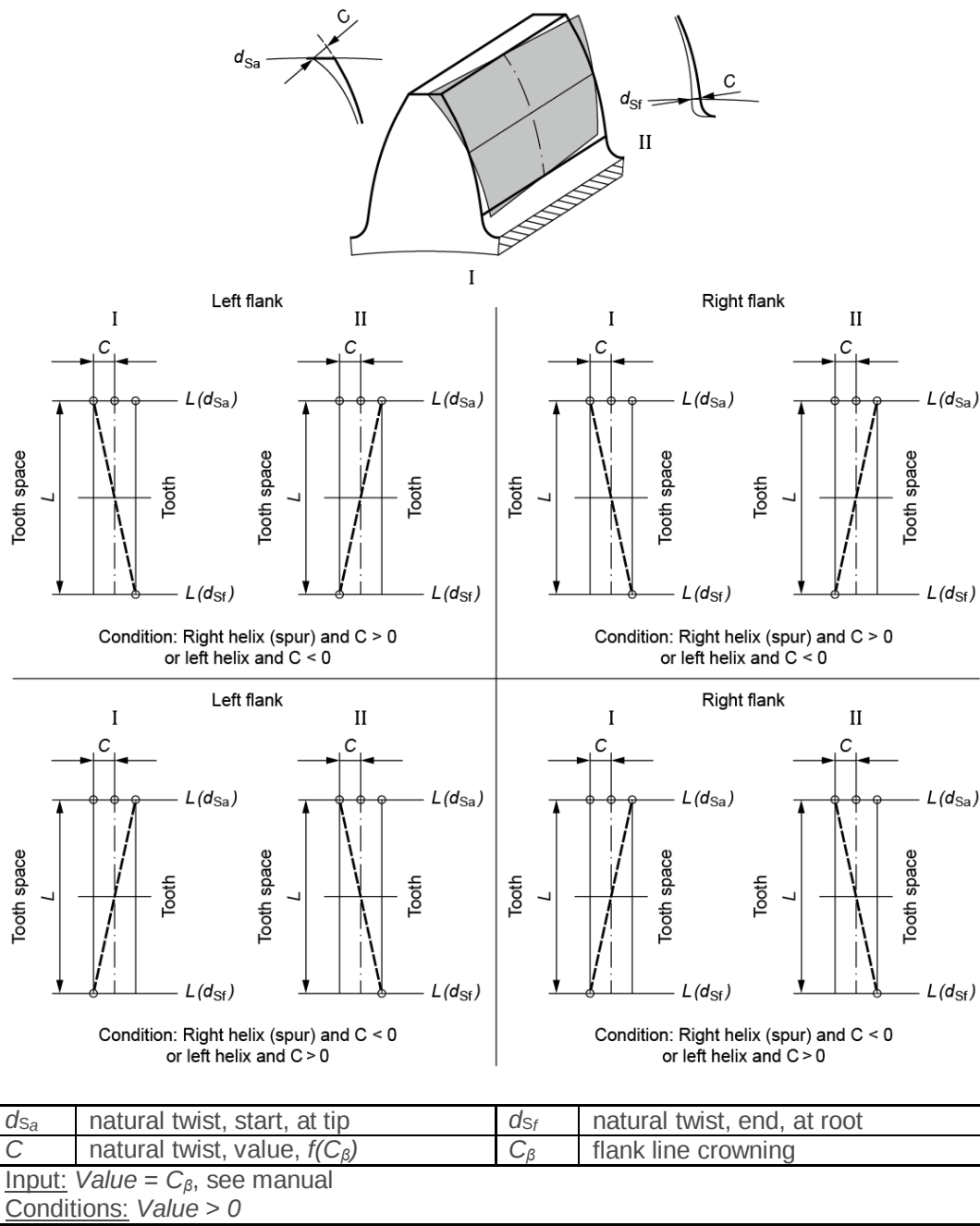
Picture: **Mod\_twist.png**



|                                                                         |                      |           |                     |
|-------------------------------------------------------------------------|----------------------|-----------|---------------------|
| $d_{s_a}$                                                               | twist, start, at tip | $d_{s_f}$ | twist, end, at root |
| C                                                                       | twist, value         |           |                     |
| <u>Inputs:</u> $Value = 4 \cdot C$<br><u>Conditions:</u> $Value \neq 0$ |                      |           |                     |

## 22 Natural twist for flank line crowning $C_\beta$ (generation grinding)

Picture: Mod\_twistManufacturing.png



# 23 Topological modification

Picture: **Mod\_topological.png**

