

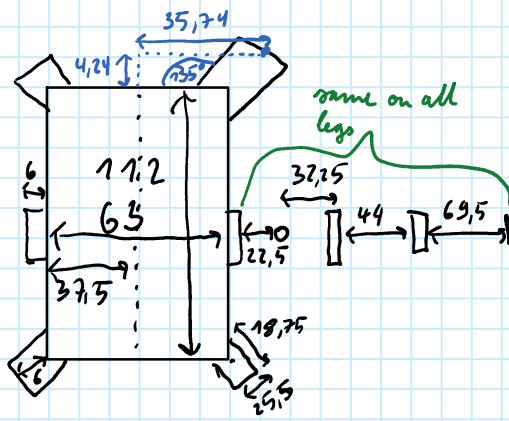
Kosinussatz:

$$d = \cos^{-1} \left( \frac{b^2 + c^2 - a^2}{2bc} \right)$$

$$\beta = \cos^{-1} \left( \frac{a^2 + c^2 - b^2}{2ac} \right)$$

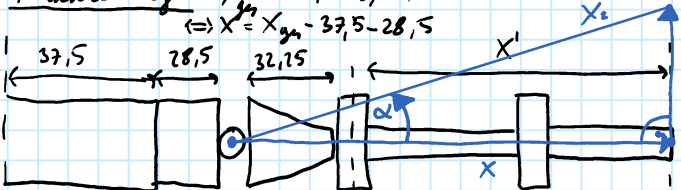
$$\gamma = \cos^{-1} \left( \frac{a^2 + b^2 - c^2}{2ab} \right)$$

Top View:



Middle leg:  $X_{gs} = 37,5 + 28,5 + X$

$$\Leftrightarrow X = X_{gs} - 37,5 - 28,5$$



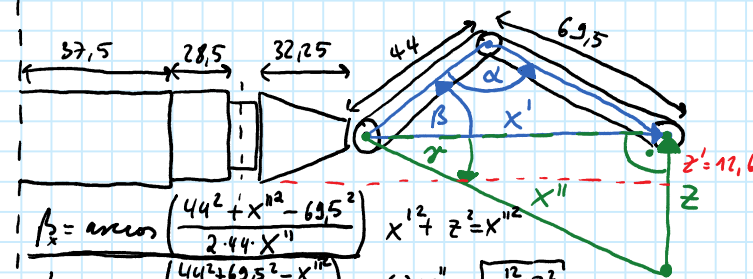
$$\sin(\alpha) = \frac{Y}{X_2} \Leftrightarrow \alpha = \arcsin\left(\frac{Y}{X_2}\right), X^2 + Y^2 = X_2^2 \Leftrightarrow X_2 = \sqrt{X^2 + Y^2}$$

$$\Rightarrow d_y = \arcsin\left(\frac{Y}{\sqrt{X^2 + Y^2}}\right)$$

$$X' = \sqrt{X^2 + Y^2} - 32,25$$

$$\Leftrightarrow X' = \sqrt{(X_{gs} - 37,5 - 28,5)^2 + Y^2} - 32,25$$

1.  $X, Y$  2.  $d_y$  3.  $X''$  4.  $d_x, \beta_x, \gamma_z$  5.  $\beta_{gs}$



$$\beta_z = \arccos\left(\frac{44^2 + X'^2 - 69,5^2}{2 \cdot 44 \cdot X''}\right)$$

$$X'^2 + Z^2 = X''^2$$

$$d_x = \arccos\left(\frac{44^2 + 69,5^2 - X''^2}{2 \cdot 44 \cdot 69,5}\right)$$

$$\Leftrightarrow X'' = \sqrt{X'^2 + Z^2}$$

$$\sin(\gamma_z) = \frac{Z}{X''} \Leftrightarrow \gamma_z = \arcsin\left(\frac{Z}{X''}\right)$$

$$\beta_{gs} = \beta_x - \gamma_z$$

Front / Back legs:

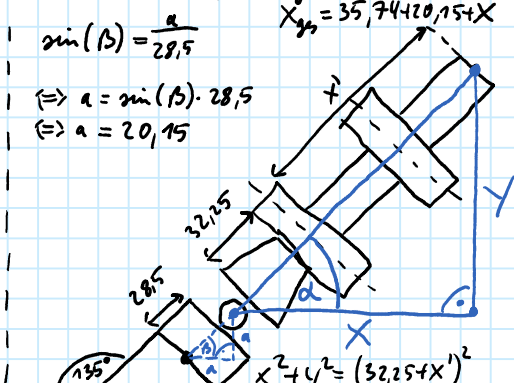
$$Y_{gs} = 56 + 20,15 + Y$$

$$X_{gs} = 35,74 + 20,15 + X$$

$$\sin(\beta) = \frac{a}{28,5}$$

$$\Leftrightarrow a = \sin(\beta) \cdot 28,5$$

$$\Leftrightarrow a = 20,15$$



$$X^2 + Y^2 = (32,25 + X')^2$$

$$\Leftrightarrow X' = \sqrt{X^2 + Y^2} - 32,25$$

$$\Leftrightarrow X' = \sqrt{(X_{gs} - 35,74 - 20,15)^2 + (Y_{gs} - 56 - 20,15)^2} - 32,25$$

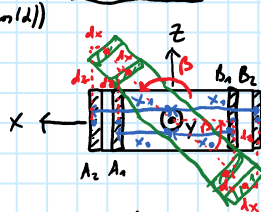
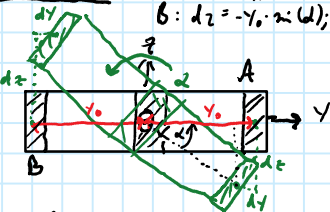
$$\sin(\alpha) = \frac{Y}{32,25 + X'} \Leftrightarrow d_y = \arcsin\left(\frac{Y}{32,25 + X'}\right) = \arcsin\left(\frac{Y}{\sqrt{X^2 + Y^2}}\right)$$

Yaw ( $R_x, \alpha$ )

Roll ( $R_y, \beta$ )

$$A: d_x = +y_0 \cdot \sin(\alpha); d_y = +y_0 \cdot (1 - \cos(\alpha))$$

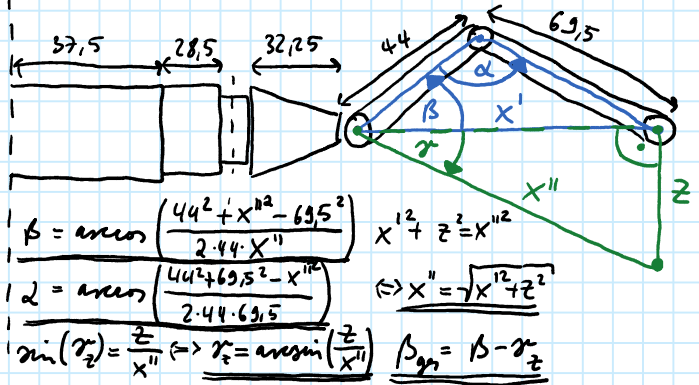
$$B: d_x = -y_0 \cdot \sin(\alpha); d_y = -y_0 \cdot (1 - \cos(\alpha))$$



Attached legs: 1, 2, 3, 4, 5, 6 (1, 2 same as 5, 6)

$$\hookrightarrow 1, 2: A_1, B_1; 3, 4: A_2, B_2$$

Attached legs: 1, 2, 5, 6



$$\beta = \arccos\left(\frac{44^2 + X'^2 - 69,5^2}{2 \cdot 44 \cdot X''}\right)$$

$$X'^2 + Z^2 = X''^2$$

$$\alpha = \arccos\left(\frac{44^2 + 69,5^2 - X''^2}{2 \cdot 44 \cdot 69,5}\right)$$

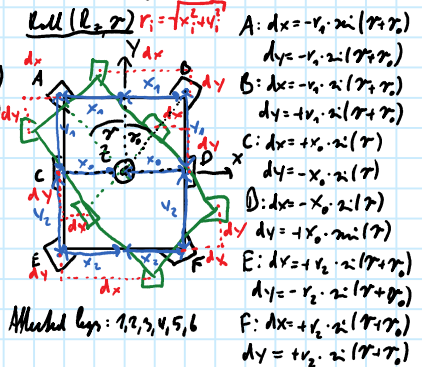
$$\Leftrightarrow X'' = \sqrt{X'^2 + Z^2}$$

$$\sin(\gamma_z) = \frac{Z}{X''} \Leftrightarrow \gamma_z = \arcsin\left(\frac{Z}{X''}\right)$$

$$\beta_{gs} = \beta - \gamma_z$$

1.  $X, Y$  2.  $d_y$  3.  $X', X''$  4.  $d, \beta, \gamma_z$  5.  $\beta_{gs}$

$$\gamma_0 = 34,089^\circ$$



Attached legs: 1, 2, 3, 4, 5, 6

$$A: d_x = -r_1 \cdot \sin(\gamma_1 \gamma_0)$$

$$d_y = -r_1 \cdot \sin(\gamma_1 \gamma_0)$$

$$B: d_x = -r_1 \cdot \sin(\gamma_1 \gamma_0)$$

$$d_y = +r_1 \cdot \sin(\gamma_1 \gamma_0)$$

$$C: d_x = +r_1 \cdot \sin(\gamma_1 \gamma_0)$$

$$d_y = -r_1 \cdot \sin(\gamma_1 \gamma_0)$$

$$D: d_x = -r_1 \cdot \sin(\gamma_1 \gamma_0)$$

$$d_y = +r_1 \cdot \sin(\gamma_1 \gamma_0)$$

$$E: d_x = +r_2 \cdot \sin(\gamma_2 \gamma_0)$$

$$d_y = -r_2 \cdot \sin(\gamma_2 \gamma_0)$$

$$F: d_x = +r_2 \cdot \sin(\gamma_2 \gamma_0)$$

$$d_y = +r_2 \cdot \sin(\gamma_2 \gamma_0)$$