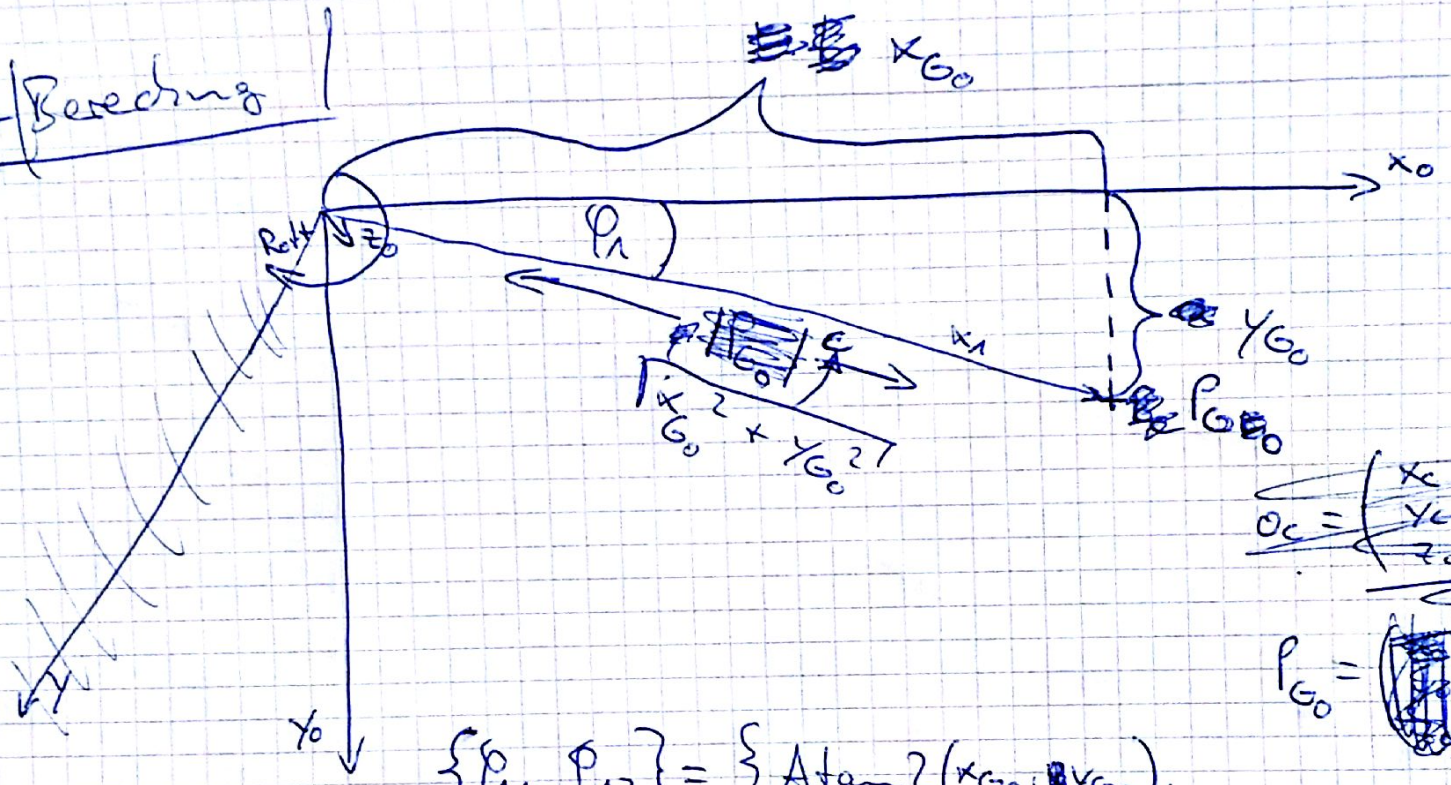
φ_1 - Berechnung



$$O_c = \begin{pmatrix} x_c \\ y_c \\ z_c \end{pmatrix} \neq \begin{pmatrix} x_{0c} \\ y_{0c} \\ z_{0c} \end{pmatrix}$$

$$P_{G0} = \begin{pmatrix} \\ \\ \end{pmatrix} \neq \begin{pmatrix} x_{G0} \\ y_{G0} \\ z_{G0} \end{pmatrix}$$

$$\{\varphi_{11}, \varphi_{12}\} = \{ \text{Atan2}(x_{G0}, y_{G0}), \; \text{Atan2}(x_{G0}, y_{G0}) + \pi \}$$

$$\tan \varphi_1 = \frac{\sin \varphi_1}{\cos \varphi_1}$$

$$\sin \varphi_1 = \frac{y_{G0}}{c}$$

$$\cos \varphi_1 = \frac{x_{G0}}{c}$$

tan wegen geiler Atan2-Funktion!

$$T_b^0 = Rot_{z q_0}\left(\frac{\pi}{2}\right) Trans_{z d_0}(0)\, Trans_{x a_0}(0)\, Rot_{x \alpha_0}(\pi)$$

$$T_0^1 = Rot_{z q_1}(q_1)\, Trans_{z d_1}(-d_1)\, Trans_{x a_1}(a_1)\, Rot_{x \alpha_1}\left(\frac{\pi}{2}\right)$$

$$T_1^2 = Rot_{z q_2}(q_2)\, Trans_{z d_2}(0)\, Trans_{x a_2}(a_2)\, Rot_{x \alpha_2}(0)$$

$$T_2^3 = Rot_{z q_3}\left(\frac{\pi}{2}+q_3\right) Trans_{z d_3}(0)\, Trans_{x a_3}(a_3)\, Rot_{x \alpha_3}\left(-\frac{\pi}{2}\right)$$

$$T_3^4 = Rot_{z q_4}(q_4)\, Trans_{z d_4}(-d_4)\, Trans_{x a_4}(0)\, Rot_{x \alpha_4}\left(\frac{\pi}{2}\right)$$