

# 1 Vorwärtsproblem

$$h_r = \sqrt{l_e^2 + h_m^2 - 2l_e h_m \cdot \cos(\phi)}$$

$$\alpha = \arcsin\left(l_e \cdot \frac{\sin(\phi)}{h_r}\right)$$

$$\beta = \pi - \alpha - \psi$$

$$h = \sin(\phi) \cdot \frac{h_b}{\sin(\beta)}$$

$$\gamma = \arcsin\left(\frac{l_r}{h_r}\right)$$

$$\delta = \pi - \beta - \gamma$$

$$b_{bottom} = \frac{\sin(\gamma)}{\sin(\delta)} \cdot h$$

$$\epsilon = \pi - \beta$$

$$\zeta = \pi - \epsilon - \gamma$$

$$b_{top} = \frac{\sin(\epsilon)}{\sin(\zeta)} \cdot h$$

$$b = b_{top} + b_{bottom}$$

$$b(l_r, l_e, h_m, h_b, \phi, \psi) =$$

$$\begin{aligned} & \left( \frac{\sin\left(\arcsin\left(\frac{l_e \cdot \sin(\phi)}{\sqrt{l_e^2 + h_m^2 - 2l_e h_m \cos(\phi)}}\right) + \psi\right)}{\sin\left(-\arcsin\left(\frac{l_r}{\sqrt{l_e^2 + h_m^2 - 2l_e h_m \cos(\phi)}}\right) + \pi - \arcsin\left(\frac{l_e \cdot \sin(\phi)}{\sqrt{l_e^2 + h_m^2 - 2l_e h_m \cos(\phi)}}\right) - \psi\right)} \right. \\ & + \left. \frac{\frac{l_r}{\sqrt{l_e^2 + h_m^2 - 2l_e h_m \cos(\phi)}}}{\sin\left(-\arcsin\left(\frac{l_r}{\sqrt{l_e^2 + h_m^2 - 2l_e h_m \cos(\phi)}}\right) + \arcsin\left(\frac{l_e \cdot \sin(\phi)}{\sqrt{l_e^2 + h_m^2 - 2l_e h_m \cos(\phi)}}\right) + \psi\right)} \right) \\ & \cdot \left( \frac{\sin(\phi) \cdot h_b}{\sin\left(\pi - \arcsin\left(\frac{l_e \cdot \sin(\phi)}{\sqrt{l_e^2 + h_m^2 - 2l_e h_m \cos(\phi)}}\right) - \psi\right)} \right) \end{aligned}$$