

$$\Sigma F = m_1 \vec{a}_1 = m_1 \begin{bmatrix} -\ddot{\theta}_1 \frac{w_1}{2} \sin(\theta_1) - \frac{w_1}{2} \dot{\theta}_1^2 \cos(\theta_1) \\ \ddot{\theta}_1 \frac{w_1}{2} \cos(\theta_1) - \frac{w_1}{2} \dot{\theta}_1^2 \sin(\theta_1) \end{bmatrix} = \vec{F}_a - \vec{F}_b$$

$$\Sigma \tau_1 = I_1 \ddot{\theta}_1 = 4\,k_a\,(\frac{3\pi}{2}-\theta_1)-4\,k_b\,(\pi-\theta_1+\theta_2)+\vec{r}_{a\rightarrow b}\times(-\vec{F}_b)$$