$$F_s = k\delta = k\frac{d}{\theta} \tag{1a}$$

$$M_t = k_t\theta \tag{1b}$$

$$\vec{M}_R = \sum_{i=1}^{n} \vec{r}_i \times \vec{F}_i + \sum_{i=1}^{m} \vec{M}_i \tag{2a}$$

$$\vec{F}_R = \sum_{i=1}^{n} \vec{F}_i \tag{2b}$$

$$\text{Let } \hat{u}_F = \frac{\vec{F}_R}{F_R} \tag{3a}$$

$$\vec{M}_{||} = \left(\vec{M}_R \cdot \hat{u}_F\right)\hat{u}_F \tag{3b}$$

$$\vec{M}_{\perp} = \vec{M}_R - \vec{M}_{||} \tag{3c}$$

$$d = \frac{M_{\perp}}{F_R} \tag{3di}$$

$$\vec{M}_{\perp} = \vec{r} \times \vec{F}_R \tag{3dii}$$