$$\boldsymbol{H}_{\mathrm{rot}} = -\gamma^{-1}\boldsymbol{\omega} \,. \tag{1}$$

$$\dot{\boldsymbol{m}} = -\gamma \boldsymbol{m} \times \boldsymbol{H}_{\mathrm{eff}} + \alpha \; \boldsymbol{m} \times \dot{\boldsymbol{m}}|_{\mathrm{Lat}} \;, \tag{2}$$

$$\boldsymbol{m} \times \dot{\boldsymbol{m}}|_{\mathrm{Lat}} = R(\phi(t)) \left(\boldsymbol{m}_R \times \dot{\boldsymbol{m}}_R\right) \;. \tag{3}$$

$$\dot{\boldsymbol{m}}_R = \boldsymbol{m}_R \times \left(-\gamma \boldsymbol{H}^R_{\mathrm{eff}} + \omega \boldsymbol{e}_z + \alpha \dot{\boldsymbol{m}}_R\right) \;. \tag{4}$$

$$0 = \boldsymbol{m}_R \times \left(-\gamma \boldsymbol{H}^R_{\mathrm{eff}} + \omega \boldsymbol{e}_z\right) \;. \tag{5}$$

$$\boldsymbol{m}_R = (\sin\theta\cos\phi, \sin\theta\sin\phi, \cos\theta) \tag{6}$$

$$\dot{\theta} = -\alpha\dot{\phi}\sin\theta = \frac{\alpha}{1+\alpha^2}\left(\omega + \gamma M_{\mathrm{s}} D\cos\theta\right)\sin\theta \,. \tag{7}$$

$$\cos\theta_2 = -\frac{\omega}{\gamma M_{\mathrm{s}} D} \,. \tag{8}$$

$$\delta\dot{\theta} = \frac{\alpha}{1+\alpha^2}\left(\gamma M_s D \pm \omega\right)\delta\theta \,, \tag{9}$$

$$\delta\dot{\theta} = \frac{\alpha}{1+\alpha^2}\frac{\omega^2 - \gamma^2 M_{\mathrm{s}}^2 D^2}{\gamma M_{\mathrm{s}} D}\delta\theta \,. \tag{10}$$