

$$\begin{aligned}
& k_{10} \left( \chi_{P1}(t) - \chi_1(t) \right) + \\
& 2 M_{P1} \left( \cos(\theta(t)) R(t) + \cos(\alpha(t)) \cos(\theta(t) + \psi(t)) \left( L_0 + \eta_1(t) + \eta_2(t) + \eta_3(t) + \eta_4(t) + \eta_5(t) + \eta_{P1}(t) \right) \right) \\
& \left( \cos(\theta(t)) R'(t) - \cos(\theta(t) + \psi(t)) \sin(\alpha(t)) \right. \\
& \quad \left( L_0 + \eta_1(t) + \eta_2(t) + \eta_3(t) + \eta_4(t) + \eta_5(t) + \eta_{P1}(t) \right) \alpha'(t) - R(t) \sin(\theta(t)) \theta'(t) - \\
& \quad \cos(\alpha(t)) \sin(\theta(t) + \psi(t)) \left( L_0 + \eta_1(t) + \eta_2(t) + \eta_3(t) + \eta_4(t) + \eta_5(t) + \eta_{P1}(t) \right) \left( \theta'(t) + \psi'(t) \right) + \\
& \quad \left. \cos(\alpha(t)) \cos(\theta(t) + \psi(t)) \left( \eta_1'(t) + \eta_2'(t) + \eta_3'(t) + \eta_4'(t) + \eta_5'(t) + \eta_{P1}'(t) \right) \right) \chi_{P1}'(t) + \\
& \left( M_{P1} \left( \cos(\theta(t)) R(t) + \cos(\alpha(t)) \cos(\theta(t) + \psi(t)) \left( L_0 + \eta_1(t) + \eta_2(t) + \eta_3(t) + \eta_4(t) + \right. \right. \right. \\
& \quad \left. \left. \left. \eta_5(t) + \eta_{P1}(t) \right) \right)^2 + i_{zp1} \right) \chi_{P1}''(t) = -c_{10} \left( \chi_{P1}'(t) - \chi_1'(t) \right)
\end{aligned}$$