

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