# Lagrange perturbation equations

$$\frac{da}{dt} = \frac{2}{na}\frac{\partial R}{\partial M}$$

$$\frac{de}{dt} = \frac{1-e^2}{ena^2}\frac{\partial R}{\partial M} - \frac{\sqrt{1-e^2}}{ena^2}\frac{\partial R}{\partial \omega}$$

$$\frac{dI}{dt} = \frac{\operatorname{cotan} I}{na^2\sqrt{1-e^2}}\frac{\partial R}{\partial \omega} - \frac{\operatorname{cosec} I}{na^2\sqrt{1-e^2}}\frac{\partial R}{\partial \Omega}$$

$$\frac{d\Omega}{dt} = \frac{\operatorname{cosec} I}{na^2\sqrt{1-e^2}}\frac{\partial R}{\partial I}$$

$$\frac{d\omega}{dt} = \frac{\sqrt{1-e^2}}{ena^2}\frac{\partial R}{\partial e} - \frac{\operatorname{cotan} I}{na^2\sqrt{1-e^2}}\frac{\partial R}{\partial I}$$

$$\frac{dM}{dt} = n - \frac{2}{na}\frac{\partial R}{\partial a} - \frac{1-e^2}{ena^2}\frac{\partial R}{\partial e}$$