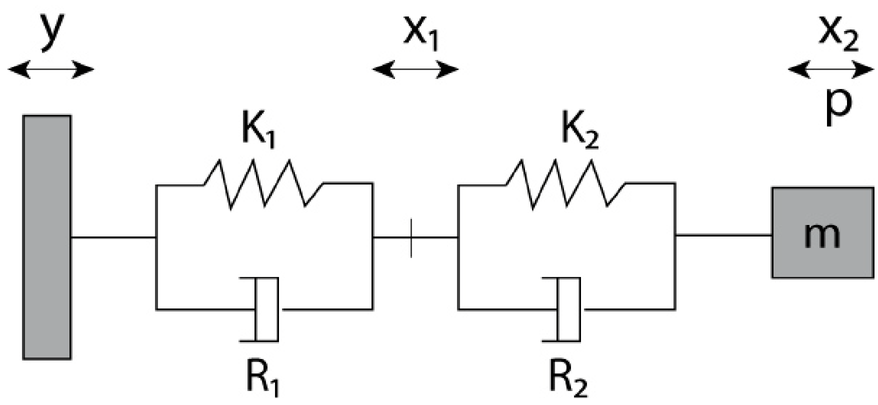
The mechanics of the eye can be approximated with the following simulation:



Y … (absolute) position of head in space
P … (absolute) position of eye in space
X_1 … (relative) position of point X_1 in head
X_1 … (relative) position of mass (point X_2) in head

With

$$p(t) = x_2(t) + y(t) \tag{1.1}$$

this leads to the following equations of motion

$$F(t) = m\frac{d^2 p(t)}{dt^2} \tag{1.2}$$

$$F(t) = -\left(k_1 x_1 + R_1 \frac{dx_1}{dt}\right) \tag{1.3}$$

$$F(t) = -\left[k_2\left(x_2 - x_1\right) + R_2 \frac{d(x_2 - x_1)}{dt}\right] \tag{1.4}$$

Using the Laplace transformation, and proceeding as described in the lecture chapter 11.1 (*Mechanics of the Vestibular System – Semicircular Canals*), the transfer function of the movement of the eye as a function of the head movement can be calculated to be

$$\frac{\widetilde{x_2}}{\tilde{y}} = \frac{-m(R_1 + R_2)\cdot s^3 - m(k_1 + k_2)\cdot s^2}{m(R_1 + R_2)\cdot s^3 + \left(m(k_1 + k_2) + R_1 R_2\right)\cdot s^2 + (R_1 k_2 + R_2 k_1)\cdot s + k_1 k_2} \tag{1.5}$$

k_1 = 2.06 g/deg
R_1 = 0.025 g*sec/deg
k_2 = 6.36 g/deg
R_2 = 1.81 g*sec/deg
m = 0.677 x 10exp-4 g*sec^2/deg