The equation is given by:

$$z(t) = d_1 \cos(\omega t) + d_2 \sin(\omega t) + r(t) - \frac{g}{\omega^2} \tag{1}$$

where

$$d_1 = z_0 - r_0 + \frac{g}{\omega^2},$$
$$d_2 = \frac{\dot{z}}{\omega} - \frac{r_T - r_0}{T\omega},$$
$$\omega = \sqrt{\frac{k}{m}}.$$