The following proportional, derivative controller has two tuning parameters: K and τ_d.

$$u(t) = K \left[e(t) + \tau_d \frac{de(t)}{dt} \right]$$

We want to apply the above controller to the following equation:

$$\frac{d}{dt} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & \alpha & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ \beta \end{bmatrix} \mu \quad (1)$$

The above equation 1 is the model of a plant.