$$P(s) = \frac{Y(s)}{U(s)} = \frac{K}{(T_1 s+1)(T_2 s+1)}$$

$$T_1 T_2 s^2 Y(s) + (T_1+T_2) s Y(s) + Y(s) = K U(s)$$

$$\Big\downarrow \mathcal{L}^{-1}$$

$$T_1 T_2 \ddot{y}(t) + (T_1+T_2)\dot{y}(t) + y(t) = K u(t)$$

$$\Big\downarrow \iint$$

$$T_1 T_2 y(t) + (T_1+T_2)\int y(t)dt + \iint y(t)dt = K \iint u(t)dt$$

$$\longrightarrow y(t) = \frac{-(T_1+T_2)\int y(t)dt - \iint y(t)dt + K\iint u(t)dt}{T_1 T_2}$$

$$Y = \begin{pmatrix} y(1) \\ y(2) \\ \vdots \\ y(n) \end{pmatrix} \qquad \phi = \begin{pmatrix} \int y(1)dt & \iint y(1)dt & \iint u(1)dt \\ \vdots & \vdots & \vdots \end{pmatrix} \qquad \hat{\theta} = \begin{pmatrix} -\frac{T_1+T_2}{T_1T_2} \\ -\frac{1}{T_1T_2} \\ \frac{K}{T_1T_2} \end{pmatrix}$$

$$\begin{cases} \theta_1 = -\frac{T_1+T_2}{T_1T_2} \\ \theta_2 = -\frac{1}{T_1T_2} \\ \theta_3 = \frac{K}{T_1T_2} \end{cases}$$

$$\begin{cases} -T_1 - T_2 = -\theta_1/\theta_2 \\ T_1T_2 = -1/\theta_2 \\ K = -\theta_3/\theta_2 \end{cases}$$

$$\theta_2 T_2^2 - \theta_1 T_2 - 1 = 0 \longleftarrow \begin{cases} T_1 = \theta_1/\theta_2 - T_2 \\ \theta_1/\theta_2\, T_2 - T_2^2 + 1/\theta_2 = 0 \\ \text{———} \end{cases}$$

$$\Delta = \theta_1^2 + 4\theta_2$$

$$T_2 = \frac{\theta_1/2 \pm \sqrt{\theta_1^2+4\theta_2}}{2\theta_2}$$

$$\longrightarrow T_2 = \frac{\theta_1/2 \pm \sqrt{\theta_1^2+4\theta_2}}{2\theta_2} \longrightarrow T_1 = \theta_1/\theta_2 - T_2$$

(the 2 solutions exchange if + or − is taken)