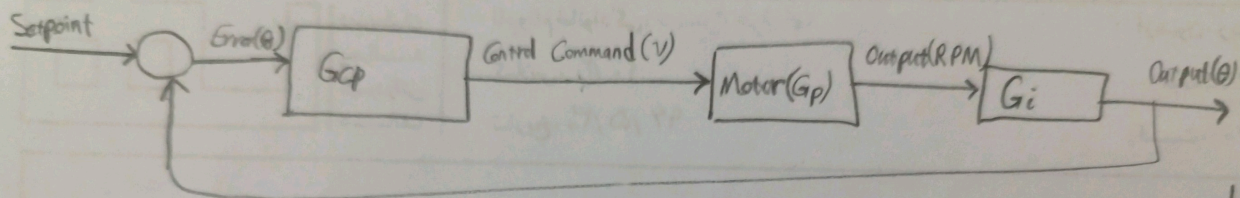


$T = 10 \text{ ms}, 50 \text{ ms}, 100$



$$F(z) = a_1 z^{-1} + a_2 z^{-2} \Rightarrow 1 - F(z) = (1 - z^{-1}) N(z) \quad , \quad U(z) = b_0 + b_1 z^{-1} \Rightarrow U(z) = \frac{Y(z)}{G(z)} = \frac{Y(z)}{R(z)} \frac{R(z)}{G(z)} \quad \leftarrow \frac{1}{1-z^{-1}}$$

$$U(z) = F(z) \left(\frac{1}{1-z^{-1}} \right) \frac{1}{G(z)}$$

تابع تبدیل سیستم : $G_p(s) = \frac{358}{0.125s + 1}$

$$G(z) = Z \left\{ \frac{1 - e^{-Ts}}{s} \frac{358}{0.125s + 1} \right\}$$

$$T=0.1 \Rightarrow G(z) = \frac{69.06z + 52.39}{z^2 - 1.435z + 0.4346} = \frac{69.06z + 52.39}{(z-1)(z-0.4343)} = \frac{z^{-1}(69.06 + 52.39z^{-1})}{(1-z^{-1})(1-0.4343z^{-1})}$$

$$V(z) = F(z) \frac{1}{1-z^{-1}} \frac{(1-z^{-1})(1-0.4343z^{-1})}{z^{-1}(69.06 + 52.39z^{-1})} = F(z) \frac{1-0.4343z^{-1}}{z^{-1}(69.06 + 52.39z^{-1})}$$

$$F(z) = z^{-1}(69.06 + 52.39z^{-1}) \cdot \underbrace{F_1}_{\text{بـ } \tilde{C}}$$

$$V(z) = (1-0.4343z^{-1}) \underbrace{F_1}_{\text{بـ } \tilde{C}} \Rightarrow 1 - a_1z^{-1} - a_2z^{-2} = (1-z^{-1})N(z) \Rightarrow N(z) = \frac{1 - a_1z^{-1} - a_2z^{-2}}{1-z^{-1}}$$

$$\begin{cases} N(z) = 1 + (1-a_1)z^{-1} \end{cases} \text{ حسب } \tilde{C}$$

$$1 - a_1 - a_2 = 0 \Rightarrow a_1 + a_2 = 1 \quad \text{بـ } \tilde{C}$$

$$\Rightarrow a_1z^{-1} + a_2z^{-2} = z^{-1}(69.06 + 0.4343z^{-1})F_1 \Rightarrow \begin{cases} a_1 = 69.06F_1 \\ a_2 = 0.4343F_1 \end{cases}$$

$$\text{misal } T=0.1 \Rightarrow \begin{cases} a_1 + a_2 = 1 \\ a_1 = 159.01 a_2 \end{cases} \Rightarrow \begin{cases} a_1 = 0.9937 \\ a_2 = 0.00625 \end{cases}$$

$$G_D(z) = \frac{1}{G(z)} \left(\frac{F(z)}{1-F(z)} \right) = \frac{(1-z^{-1})(1-0.4343z^{-1})}{z^{-1}(69.06 + 52.39z^{-1})} \times \frac{(0.9937z^{-1} + 0.00625z^{-2})}{(1-0.9937z^{-1} - 0.00625z^{-2})}$$

$$\text{مثال: } T=0.01 \Rightarrow G(z) = \frac{0.8706z + 0.8468}{z^2 - 1.92z + 0.92} = \frac{0.8706z + 0.8468}{(z-1)(z-0.92)} = \frac{z^{-1}(0.8706 + 0.8468z^{-1})}{(1-z^{-1})(1-0.92z^{-1})}$$

$$U(z) = F(z) \frac{1}{1-z^{-1}} \cdot \frac{(1-z^{-1})(1-0.92z^{-1})}{z^{-1}(0.8706 + 0.8468z^{-1})} = F(z) \frac{1-0.92z^{-1}}{z^{-1}(0.8706 + 0.8468z^{-1})}$$

$$\Rightarrow F(z) = z^{-1}(0.8706 + 0.8468z^{-1})F_1 \Rightarrow U(z) = (1-0.92z^{-1})F_1$$

$$\Rightarrow \text{بالنسبة لـ } a_1z^{-1} + a_2z^{-2} = z^{-1}(0.8706 + 0.8468z^{-1})F_1 \Rightarrow \begin{cases} a_1 = 0.8706F_1 \\ a_2 = 0.8468F_1 \end{cases} \Rightarrow a_1 = 1.0281a_2$$

$$\begin{cases} a_1 + a_2 = 1 \\ a_1 = 1.0281a_2 \end{cases} \Rightarrow \begin{cases} a_1 = 0.5069 \\ a_2 = 0.493 \end{cases} \Rightarrow G_D(z) = \frac{1}{G(z)} \left(\frac{F(z)}{1-F(z)} \right)$$

$$G_D(z) = \frac{(1-z^{-1})(1-0.92z^{-1})}{z^{-1}(0.8706 + 0.8468z^{-1})} \times \frac{(0.5069z^{-1} + 0.493z^{-2})}{(1-0.5069z^{-1} - 0.493z^{-2})}$$

$$\text{مثال: } T=0.05 \Rightarrow G(z) = \frac{19.57z + 17.03}{z^2 - 1.659z + 0.6592} = \frac{19.57z + 17.03}{(z-1)(z-0.6596)} = \frac{z^{-1}(19.57 + 17.03z^{-1})}{(1-z^{-1})(1-0.6596z^{-1})}$$

$$U(z) = F(z) \frac{1}{1-z^{-1}} \cdot \frac{(1-z^{-1})(1-0.6596z^{-1})}{z^{-1}(19.57 + 17.03z^{-1})} = F(z) \frac{(1-0.6596z^{-1})}{z^{-1}(19.57 + 17.03z^{-1})}$$

$$F(z) = z^{-1}(19.57 + 17.03z^{-1})F_1, U(z) = (1-0.6596z^{-1})F_1$$

$$\Rightarrow \text{بالنسبة لـ } a_1z^{-1} + a_2z^{-2} = z^{-1}(19.57 + 17.03z^{-1})F_1 \Rightarrow \begin{cases} a_1 = 19.57F_1 \\ a_2 = 17.03F_1 \end{cases} \Rightarrow a_1 = 1.1491a_2$$

$$\begin{cases} a_1 + a_2 = 1 \\ a_1 = 1.1491a_2 \end{cases} \Rightarrow \begin{cases} a_1 = 0.5347 \\ a_2 = 0.4653 \end{cases} \Rightarrow G_D(z) = \frac{1}{G(z)} \frac{F(z)}{1-F(z)}$$

$$G_D(z) = \frac{(1-z^{-1})(1-0.6596z^{-1})}{z^{-1}(19.57 + 17.03z^{-1})} \times \frac{0.5347z^{-1} + 0.4653z^{-2}}{1 - 0.5347z^{-1} - 0.4653z^{-2}}$$