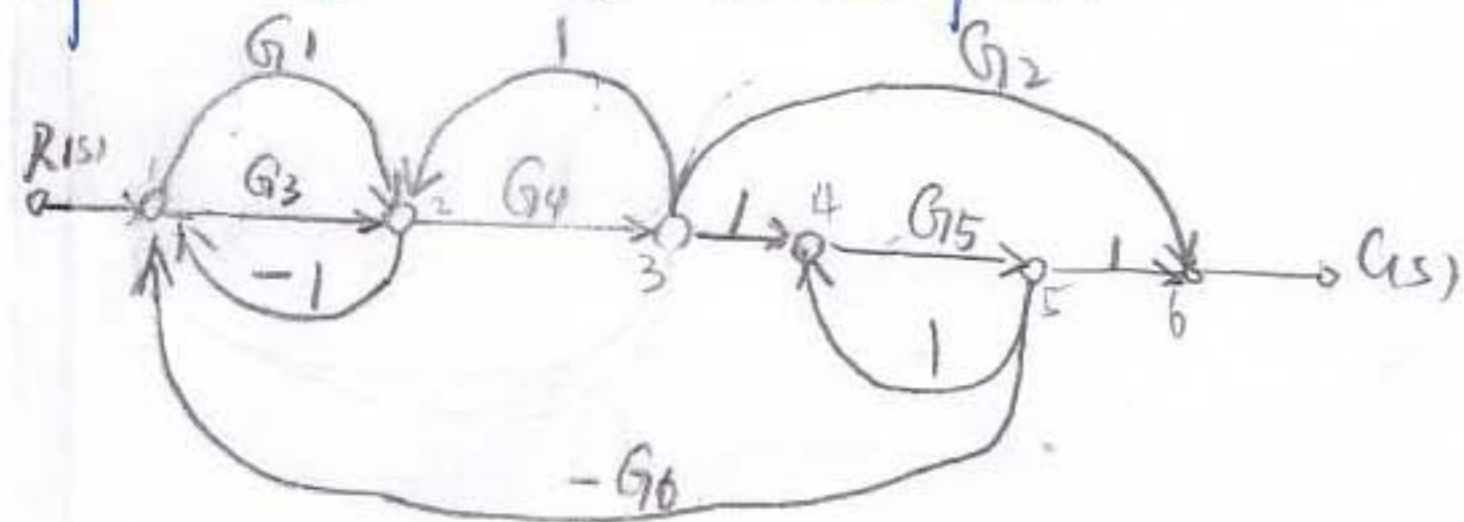


2015年 845 自动控制理论 参考答案

解: 系统信号流程图如图所示.



$$\Delta = 1 + G_3 + G_1 - G_4 + G_5 + G_3 G_4 G_5 G_6 + G_1 G_4 G_5 G_6 - G_1 G_5 - G_3 G_5 + G_4 G_5$$

$$\Delta_1 = G_3 G_4 G_5 \quad P_1 = 1$$

$$\Delta_2 = G_1 G_4 G_5 \quad P_2 = 1$$

$$\Delta_3 = G_1 G_4 G_2 \quad P_3 = 1 - G_5$$

$$\Delta_4 = G_3 G_4 G_2 \quad P_4 = 1 - G_5$$

$$\frac{C(s)}{R(s)} = \frac{\Delta_1 P_1 + \Delta_2 P_2 + \Delta_3 P_3 + \Delta_4 P_4}{\Delta}$$

$$= \frac{G_3 G_4 G_5 + G_1 G_4 G_5 + G_1 G_2 G_4 (1 - G_5) + G_3 G_2 G_4 (1 - G_5)}{1 + G_3 + G_1 - G_4 + G_5 + G_3 G_4 G_5 G_6 + G_1 G_4 G_5 G_6 - G_1 G_5 - G_3 G_5 + G_4 G_5}$$

∵ 扰动为正弦信号且输出稳态值为 2.0.

∴ 扰动函数 $\Phi_n(s) = 0$.

由图分析得知.

$$N(s) + N(s) \times \frac{(T_2 s + K_2) \times 2}{5s + K_1} = 0$$

$$\therefore T_2 = -2.5 \quad K_2 = -7.8$$

$$\text{综上: } k_1 = 15.6 \quad k_2 = -7.8 \quad T_1 = 0.5 \quad T_2 = -2.5$$

$$2. \quad \zeta = 0.25 \quad \omega_n = \sqrt{\frac{2}{T_1}} = 2$$

$$\sigma\% = e^{-\frac{\zeta}{\sqrt{1-\zeta^2}}} \times 100\% = 40\%$$

$$t_p = \frac{T_1}{\omega_n \sqrt{1-\zeta^2}} = 1.6365$$

$$t_s = \frac{4T_1}{3\omega_n} = 7.857 \text{ s } (\Delta = 2\%)$$

$$t_s = \frac{5T_1}{3\omega_n} = 6.25 \text{ s } (\Delta = 5\%)$$