

淡江大學八十八學年度碩士班招生考試試題

系別：機械工程學系

科目：自動控制

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本試題雙面印製

1. (20%) Fig.1 shows three different pole/zero patterns and six different kinds of step responses, 'x' represents poles and 'o' represents zeros. Find the step response to match each pole/zero pattern and give your reasoning for the choices.

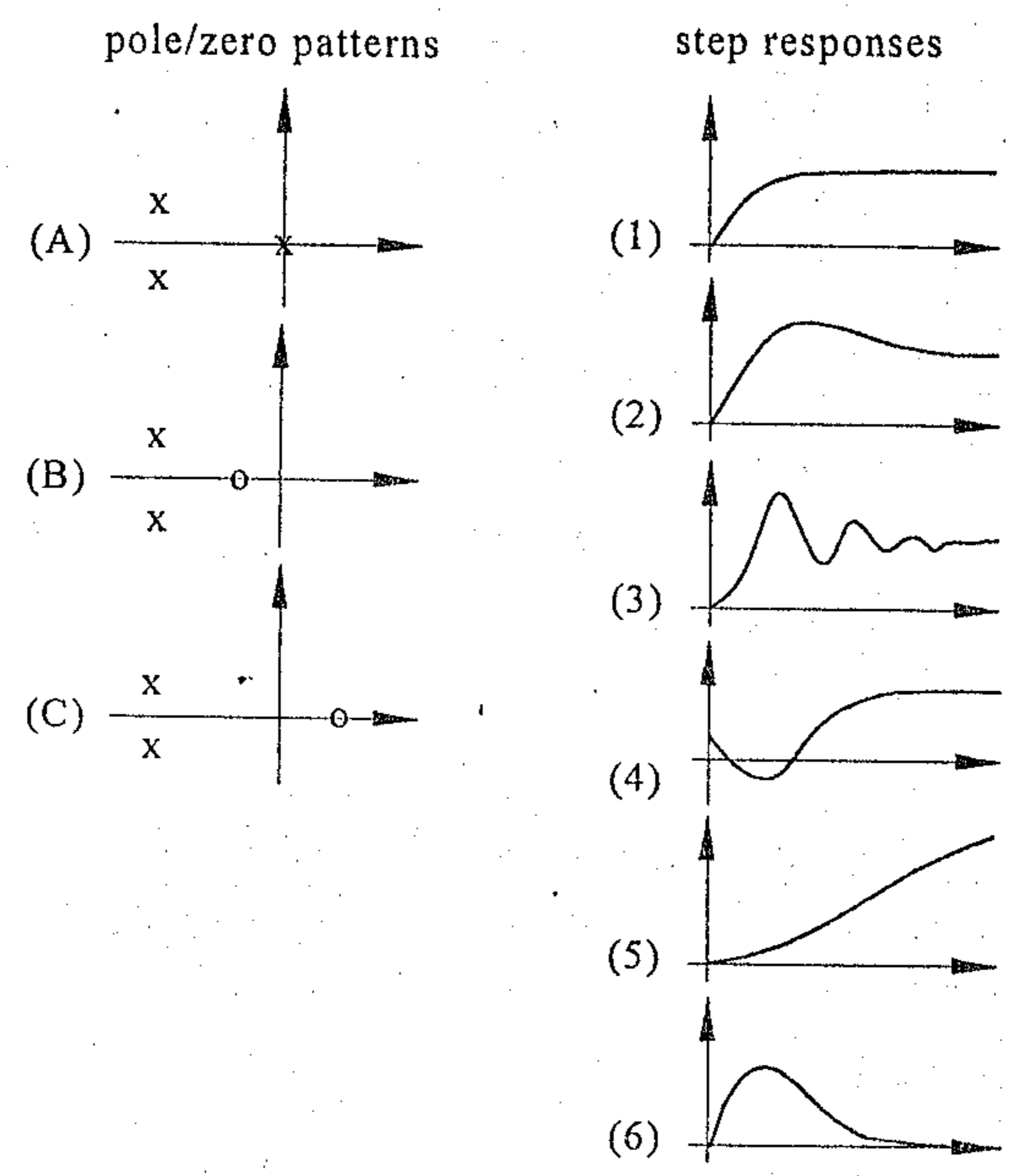


Fig. 1

2. (20%) The block diagram of a feedback control system is shown in Fig. 2, and the Bode plot of $G(s)$ is shown in Fig. 3,
- What is the maximum value for K when the system is stable ?
 - Find the steady state error of $E(s)$ when $R(s)$ is a unit ramp function ?

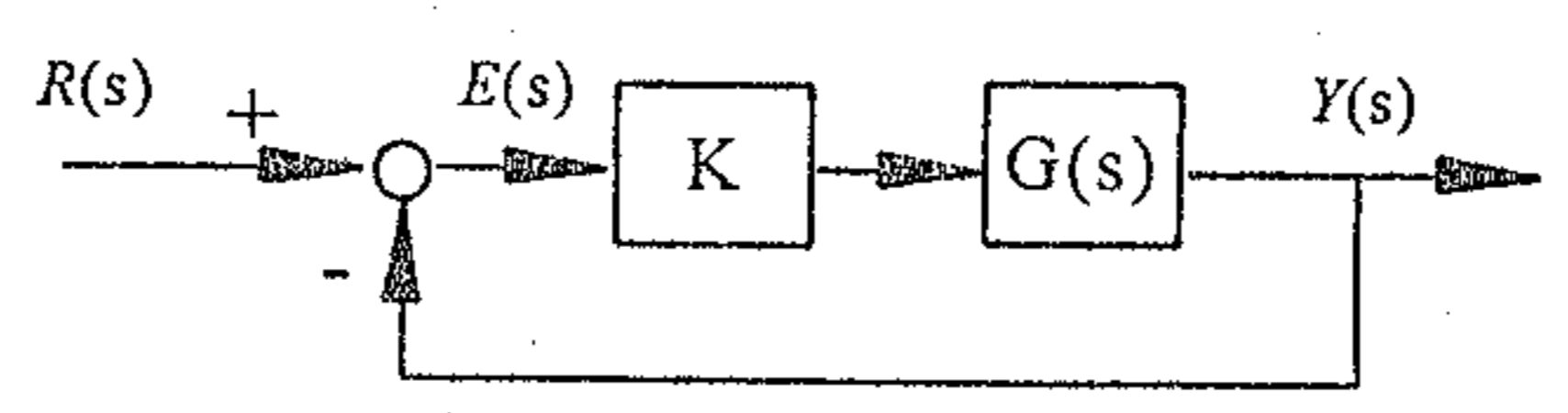


Fig. 2

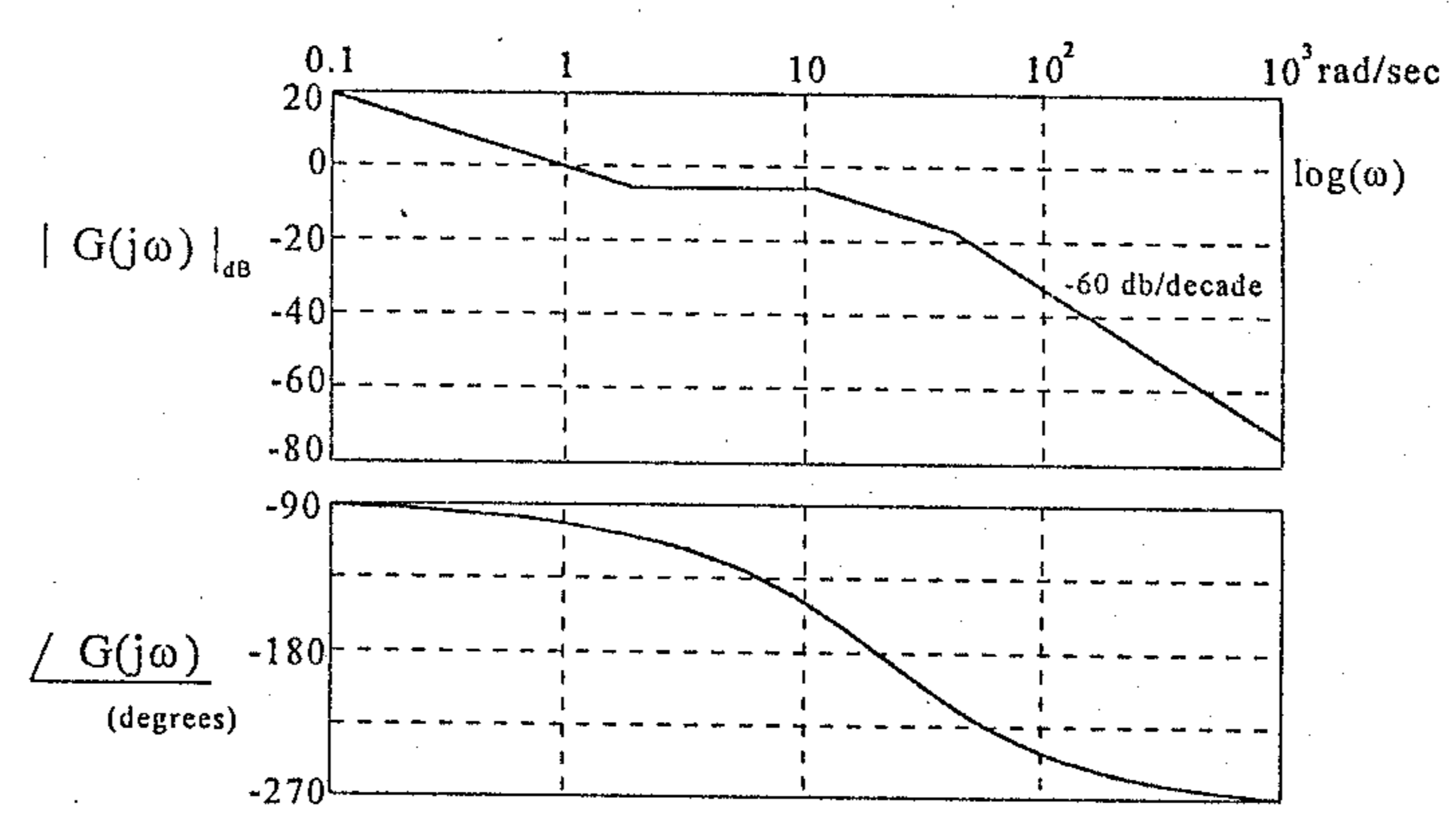


Fig. 3

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3. (20%) The block diagram of a feedback control system is shown in Fig. 4, if the proportional gain $K = 1$, sketch the root loci of the system when the velocity feedback gain K_t varies from 0 to ∞ .

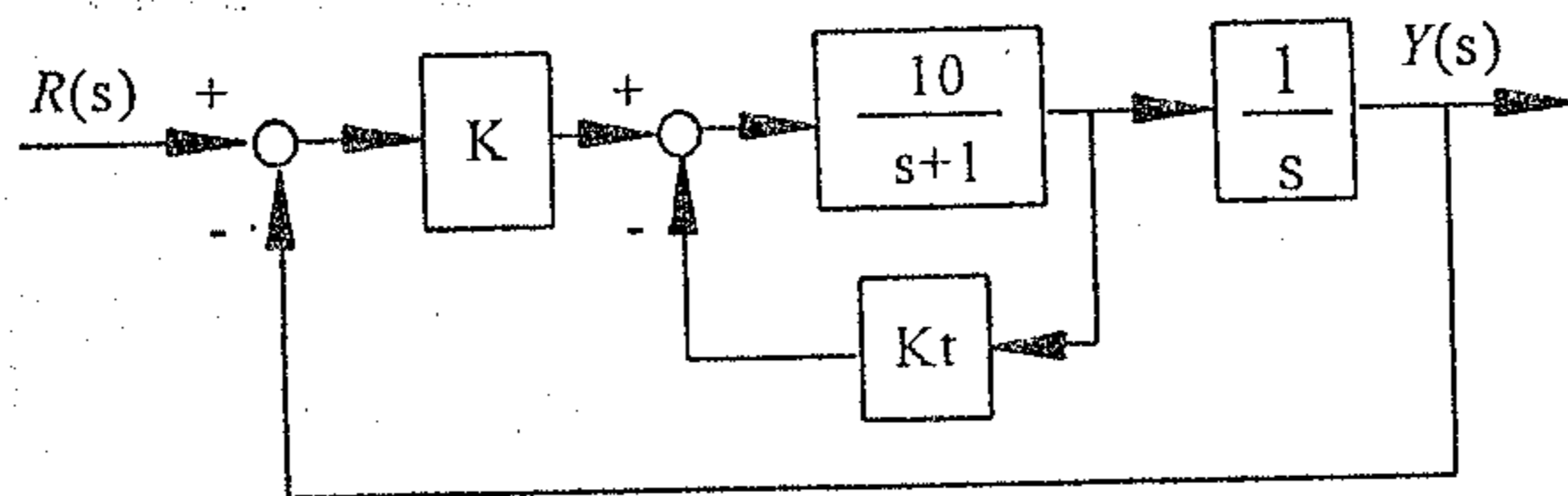


Fig. 4

4. (40%) The model of a dc motor is shown in Fig. 5, e is the motor input voltage, T_d is the disturbance input,

- Find the transfer function $\frac{i(s)}{e(s)}$?
- If a proportional-plus-integral (PI) controller is to be designed to control the motor current, let the controller $= k_p + \frac{k_i}{s}$, i^* is the current command, and the motor current i can be measured directly, find the close loop transfer function $\frac{i(s)}{i^*(s)}$?
- What is the steady state error of current for the PI current controller when i^* is a unit step?
- If k_p and k_i are limited, can the steady state error be reduce to zero? explain why?
- What is the influence of T_d on the performance of the PI current controller?
- What will the performance of the controller change if k_i is set to 0?

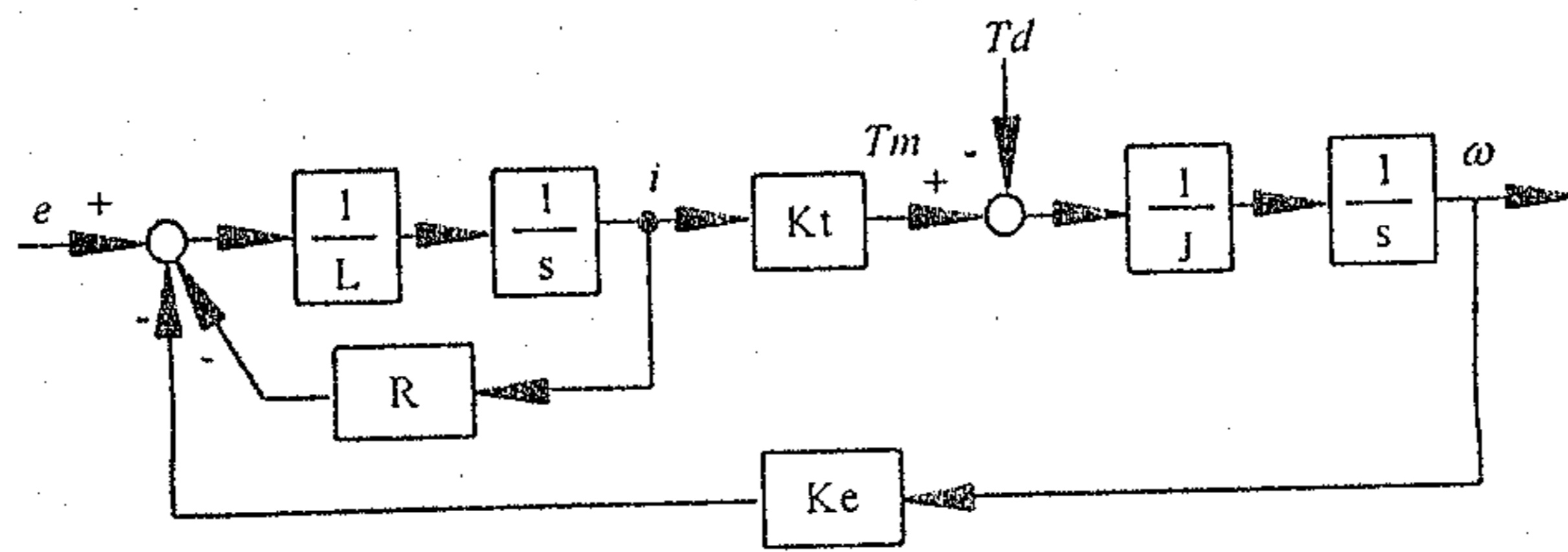


Fig. 5