

國立臺北科技大學

102 學年第一學期電機系博士班資格考試

控制系統(大學部) 試題

第一頁 共二頁

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注意事項：

1. 本試題共 5 題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在試卷答案欄內，否則不予計分。
4. 考試時間：二小時。
5. 可用計算機。

1. A first step toward a realistic (non-ideal) model of an op amp is given by the equations:

$$V_{out} = \frac{10^7}{s+1}(V_+ - V_-)$$
$$i_+ = i_- = 0$$

10% (a) Show that the op amp connection shown in Fig. 1(a) is unstable.

10% (b) Find the transfer function of the simple amplification circuit shown Fig. 1(b).

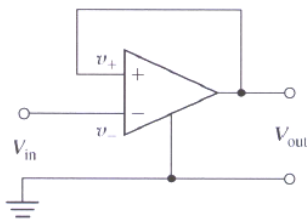


Fig. 1(a)

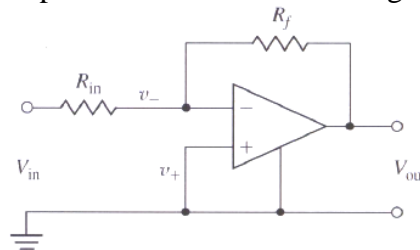


Fig. 1(b)

2. For the characteristic equation

$$1 + \frac{K}{s(s+1)(s+5)} = 0$$

10% (a) Sketch the corresponding root locus.

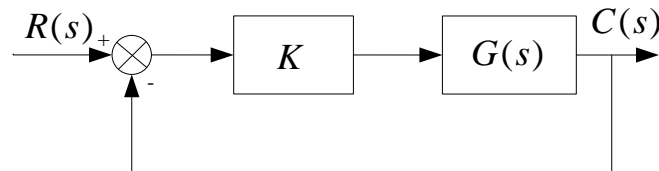
5% (b) Sketch the asymptotes of the locus for $K \rightarrow \infty$.

5% (c) For what value of K are the roots on the imaginary axis?

3. Given the transfer function $G(s) = \frac{s+3}{(s^2+1)(s+5)(s-1)}$.

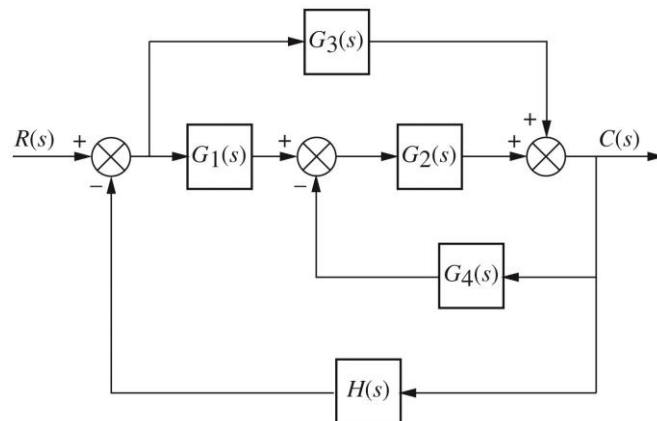
5% (a) Determine whether the open-loop system $G(s)$ is stable. Justify your answer.

5% (b) Consider the following system. Find the equivalent transfer function $C(s)/R(s)$.



10% (c) Find the range of K such that the closed-loop system in (b) is stable.

4. Considering the following system.



10% (a) Find the equivalent transfer function $C(s)/R(s)$.

10% (b) Let $G_1(s) = -1$, $G_2(s) = s$, $G_3(s) = 11$, $G_4(s) = s$, $H(s) = 1$. Find the steady-state errors for the step input and the ramp input, if possible.

5. Find the transfer function and a state space description of the following system. (20%)

