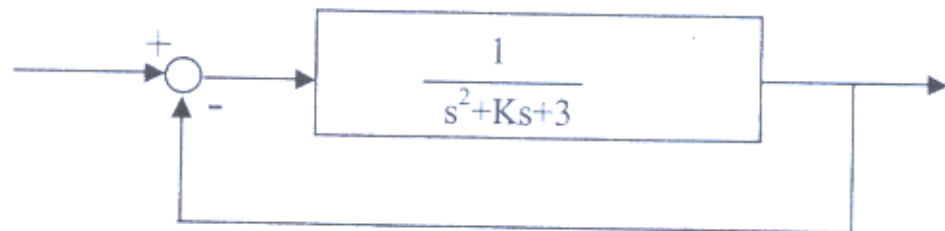


1. What are the advantages and disadvantages of feedback control? Construct your model and support your statement from related analyses. (20%)
2. If a dynamic system can be described as a third-order time-invariant one, find the stability condition for the dynamic system. How can you obtain a stability condition when the system is expected to have certain margin in stability? (15%)
3. Use block diagram model and operation to support the statement: "A DC-servo position control system with tachometer feedback is equivalent to increase the damping of the control system." (15%)

(背面仍有題目,請繼續作答)

4. There exists a unity-feedback system whose block diagram is shown as follows. However, the system parameter " K " is almost unknown. All we have known is that it is ensured as a positive real scalar. Please apply Root Locus Technique to
- (A). describe, by portrait of root locus, how the value of " K " varies to affect the pole locations, in the complex s plane, of the closed-loop system, and (10%)
- (B). what the value of " K " has to be if the closed-loop system must retain a damping ratio at 0.707 such that its performance requirement is satisfied. (5%)



5. The forward-path transfer function of a unity-feedback control system is $G(s) = K/(s+5)^n$, $n \in N$, $-\infty < K < \infty$.
- (A). Determine, by means of Nyquist criterion, the range of " K " for the closed-loop to be stable respectively if $n=2$ and $n=4$. (10%)
- (B). Calculate the gain margin and phase margin if $K=1$ and $n=2$. (10%)
6. If the plant transfer function of an aircraft attitude unity-feedback control system is $G(s) = \frac{4500K}{s(s+361.2)}$, one of the performance requirements in time domain is that the steady-state error, due to a parabolic input, $0.5 t^2 u(t)$, where $u(t)$ is the unit step function, has to be less than 0.2. Applying PI controller as $G_c(s) = \frac{K_p(s + K_I/K_p)}{s}$
- (A). what is the minimum value of K_I if $K=181.17$? (5%)
- (B). cont'd from result of (A), what is the minimum value of K_p for the closed-loop system to remain stable? (5%)
- (C). what is the value of K_I if $K=181.17$, $K_p=0.1 K_I$ and desired damping ratio of the closed-loop system is set to be 0.707? (5%)