-: Autonomic Computing :-

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÷ Home Work - 4 :-

Answers :- (3.8)

(a) ~~transfer function~~ function given : $2z/(z^2 - 14z - 0.45)$

(i) Order of ~~functions~~ the system = 2

(ii) Poles of the system = $\{1.67, 0.27\}$

(iii) Poles are outside the unit circle, Therefore system is not stable.

(b)

(c) function given : ~~$1/(z \ldots)$~~

$13/(z^4 - z^3 + 0.35z^2 - 0.05z - 0.024)$

(i) Order of the system = 4

(ii) Poles of the system = $\{0.67, 0.25 + 0.39i, 0.25 - 0.39i, -0.17\}$

(iii) Poles seems to be inside, so system is stable.

Answer :- (3.9)

(a) Given system : $0.94/(z - 0.57)$

(i) Poles = $\{0.57\}$ which is inside the unit circle, so system is stable.

(ii) final value of unit step input :

$$\lim_{k \to \infty} y(k) = \lim_{z \to 1} (z-1) Y(z)$$

for step input $U(z) = z/(z-1)$

$$\therefore \lim_{z\to 1} (z-1)\, Y(z)\, U(z) = \lim_{z\to 1} (z-1) \times \frac{0.94}{(z-0.51)} \times \frac{z}{(z-1)}$$

$$= \lim_{z\to 1} \frac{0.94z}{(z-0.51)}$$

$$= 0.94/0.49$$

$$= 1.9184$$

(iii) Settling time, $k_s = -4/\log|a| = 6$

(iv) Step Response : $y(k+1) = a\,y(k) + b\,u(k)$

$u(k)$: step $\Rightarrow u(k) = 1$

$y(k+1) = 0.51\,y(k) + 0.94$

k	y(k)
0	0
1	0.94
2	1.42
3	1.66
4	1.79
5	1.85
6	1.88
7	1.90
8	1.90
9	1.91
10	1.92
11	1.92

So from the tabular data we can say that it reaches stable stable (steadystate) at around step 6 ⟺ 9

Q20 Answer: (5.3)

(a) Given values RIS = 0 ... (2) Max Users = 165

therefore $u(k) = 0$ ..... (1)

and $y(0) = RIS(0) - RIS = -135$

Linear equation : $y(k+1) = 0.43\, y(k) + 0.47\, u(k)$

from eq- (1)

$$y(k+1) = 0.43\, y(k)$$

$\therefore$ $\cancel{y(k) = (0.43^k)\, y(k)}$ RIS $= y(k) + 135$

$$y(k) = (0.43k)\, y(0)$$

Answer : (6.3)

(a) Second order system: $1/(z-1.5)(z-0.5)$

(i) Poles = $\{1.5, 0.5\}$

(ii) Pole is outside the unit circle therefore system is unstable.

(iii) Steady state gain cannot be desired as its unstable.

(v) Due to instability we cannot calculate settling time

(6.3)

(c) Second order given : $-1/(z+0.2)(z-0.2)$

(i) Poles = { 0.2, -0.2 }

(iii) System is stable.

(iv) Steady state gain for system ; $G(1) = -1.04$

(v) Settling time $k_s = -4/\log|a|$

$= -4/\log|0.2| = 2.49$

Answer : (9.2)

Given $G(z) = 0.47/(z-0.43)$ $k_p = 2$ and $k_i = 1$

(a) Close loop transfer $f_R(z) = Y(z)/R(z)$

$$= \frac{(k_p + k_i)z - k_p \cdot G(z)/z-1}{}$$

$$= \frac{1.41z - 0.94}{z^2 - 0.02z - 0.51}$$

(b) Dominate close loop poles = { 0.724, -0.704 }

for it $k_s = 4/\log|a| = -4/\log|0.724|$

$= 12.38$

Peak Overshoot value $M_{peak} = 0$ because dominate pole is positive