(3.8 a)

(i) Order of the system = 2

(ii) Poles = 1.6695 and -0.2695

(iii) System is not stable as the there is a pole outside the unit circle.

(3.8 c)

(i) Order of the system = 4

(ii) Poles = 0.6687, 0.2500 + 0.3877i, 0.2500 - 0.3877i, -0.1687

(iii) System is stable.

(3.9 a)

(i) System is stable as the pole is within the unit circle.

(ii) Final value : = 0.94 / 0.49 = 1.918

(iii) Settling time ks = -4/log|a| = 6

(iv) Step response : y(k+1) = 0.51y(k) + 0.94

|  |  |
| --- | --- |
| k | y(k) |
| 0 | 0 |
| 1 | 0.94 |
| 2 | 1.4194 |
| 3 | 1.663894 |
| 4 | 1.788586 |
| 5 | 1.852179 |
| 6 | 1.884611 |
| 7 | 1.901152 |
| 8 | 1.909587 |
| 9 | 1.91389 |
| 10 | 1.916084 |
| 11 | 1.917203 |
| 12 | 1.917773 |
| 13 | 1.918064 |
| 14 | 1.918213 |
| 15 | 1.918289 |
| 16 | 1.918327 |

At 6 timestep, we could see the value of y(k) almost reached the steady state value as given in (ii) and (iii).

(3.9 b)

Poles : 0.4849 + 0.8153i, 0.4849 - 0.8153i, 0.3909, -0.0506

(i) System is stable.

(ii) Final value = 11.76

(iii) settling time k = -4/log |r| = 76.4

(iv) step response:

y(k+4) = 1.31y(k+3)-1.21y(k+2)+0.287y(k+1)+0.0178y(k)+7

(5.3) RIS(0) = 0, MaxUsers = MaxUsers = 165 so u(k) = 0

y(0) = RIS(0) – RIS = -135

In general, we have y(k+1) = 0.43y(k) + 0.47u(k)

y(k+1) = 0.43y(k) since u(k) = 0

y(k) = (0.43)k \* y(0) and RIS(k) = y(k) + 135

Settling time ks = -4 / log|a| = -4/log|0.43| = 5

settling value approximately 134.99.

6.3a)

1. Poles: 1.5, 0.5
2. Plot
3. The system is not stable as there is a pole outside the unit circle.
4. SA description...ince the system is not stable, Steady state gain cannot be obtained.
5. Step response curve
6. settling time to step input - Since the system is not stable, settling time cannot be calculated.

6.3c)

1. Poles: 0.2, -0.2
2. Plot
3. System is stable.
4. Steady state gain G(1) = -1.04
5. step response curve
6. settling time to step input – ks = -4/log|0.2| = 2.485

9.2 G(z) = kp = 2, ki = 1

(a) Closed loop transfer function FR(z) = Y(z) / R(z)

=

Substituing the values of Kp, Ki and G(z) we get

=

(b) Dominant closed loop poles

= 0.724, -0.704

Ks = -4 / log|0.724| = 12.38

= 13

Peak overshoot Mp = 0 since the dominant pole is positive.

(c)