EE 2007 35-51

EE24BTECH11005 - Arjun Pavanje

35) The system $\frac{900}{s(s+1)(s+9)}$ is to be compensated such that its gain-crossover frequency becomes same as its uncompensated phase-crossover frequency and provides a 45° phase margin. To achieve this, one may use

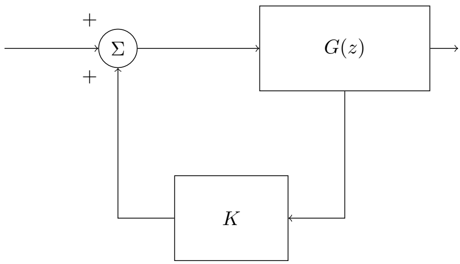
a) A lag compensator that provides an attenuation of $20dB$ and a phase lag of $45°$ at the frequency of $3\sqrt{3}rad/s$

b) A lead compensator that provides an amplification of $20dB$ and a phase lead of $45°$ at the frequency of $3rad/s$

c) A lag-lead compensator that provides an amplification of $20dB$ and a phase lag of $45°$ at the frequency of $\sqrt{3}rad/s$

d) A lag-lead compensator that provides an attenuation of $20dB$ and a phase lead of $45°$ at the frequency of $3rad/s$

36) Consider the discrete-time system shown in the figure where the impulse response of $(G(z))$ is $g(0) = 0, g(1) = g(2) = 1, g(3) = g(4) = ... = 0$. This system is stable for the range of values of K



a) $\left[-1, \frac{1}{2}\right]$

b) $[-1, 1]$

c) $\left[-\frac{1}{2}, 1\right]$

d) $\left[-\frac{1}{2}, 2\right]$

37) A signal $x(t)$ is given by

$$x(t) = \begin{cases} 1, & -\frac{T}{4} < t \leq \frac{3T}{4} \\ -1, & \frac{3T}{4} < t \leq \frac{7T}{4} \\ -x(t+T) & \end{cases}$$

Which among the following gives the fundamental Fourier term of $x(t)$?

a) $\frac{4}{\pi}\cos\left(\frac{\pi t}{T} - \frac{\pi}{4}\right)$

b) $\frac{\pi}{4}\cos\left(\frac{\pi t}{2T} + \frac{\pi}{4}\right)$

c) $\frac{4}{\pi}\sin\left(\frac{\pi t}{T} - \frac{\pi}{4}\right)$

d) $\frac{\pi}{4}\sin\left(\frac{\pi t}{2T} + \frac{\pi}{4}\right)$

38) If the loop gain K of a negative feedback system having a loop transfer function $\left[K\frac{(s+3)}{(s+8)^2}\right]$ is to be adjusted to induce a sustained oscillation then

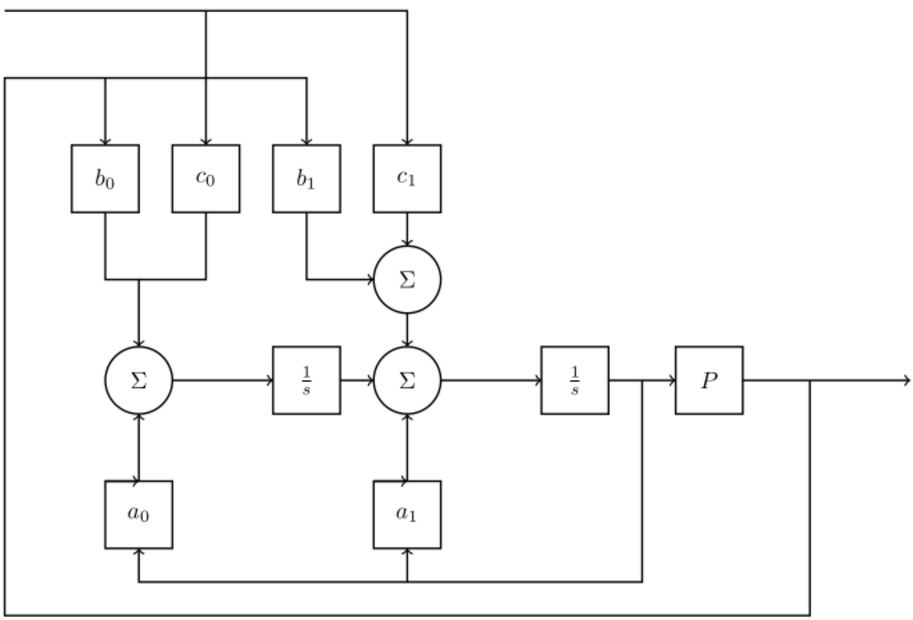
a) The frequency of this oscillation must be $\frac{4}{\sqrt{3}} rad/s$

b) The frequency of this oscillation must be must be $4 rad/s$

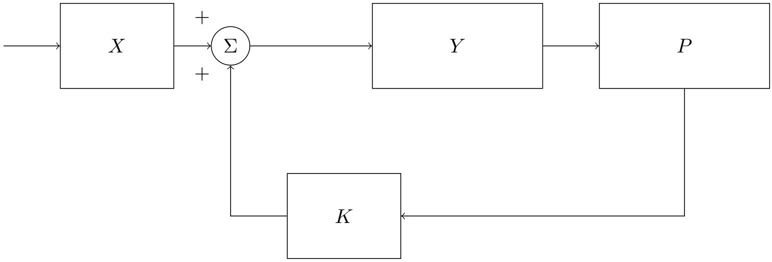
c) The frequency of this oscillation must be must be 4 or $\frac{4}{\sqrt{3}} rad/s$

d) such a K does not exist

39) The system shown in the figure below,



can be reduced to the form,



a)

$$X = c_0 s + c_1$$
$$Y = \frac{1}{(s^2 + a_0 s + a_1)}$$
$$Z = b_0 s + b_1$$

b)

$$X = 1$$
$$Y = \frac{(c_0 s + c_1)}{(s^2 + a_0 s + a_1)}$$
$$Z = b_0 s + b_1$$

c)

$$X = c_0 s + c_1$$
$$Y = \frac{(b_1 s + b_0)}{(s^2 + a_1 s + a_0)}$$
$$Z = 1$$

d)

$$X = c_0 s + c_1$$
$$Y = \frac{1}{(s^2 + a_1 s + a_0)}$$
$$Z = b_1 s + b_0$$

40) The value of $\oint_C \frac{dz}{(1+z^2)}$, where C is the contour $\left|z - \frac{i}{2}\right| = 1$ is

a) $2\pi i$

b) π

c) $\tan^{-1} z$

d) $\pi.i.tan^{-1}z$

41) A single-phase voltage source inverter is controlled in a single pulse-width modulated mode with a pulse width of 150° in each half cycle. Total harmonic distortion is defined as THD $= \frac{\sqrt{V_{rms} - V_n^2}}{V_1} \times 100$, where V,is the rms value of the fundamental component of the output voltage. The THD of output ac voltage waveform is

a) 65.65%

b) 48.42%

c) 31.83%

d) 30.49%

42) A voltage source inverter is used to control the speed of a three-phase, $50Hz$, squirrel cage induction motor. Its slip for rated torque is 4%. The flux is maintained at the

rated value. If the stator resistance and rotational losses are neglected, the frequency of the impressed voltage to obtain twice the rated torque at starting should be:

a) $10Hz$
b) $5Hz$
c) $4Hz$
d) $2Hz$

43) A three-phase, $440V, 50Hz$ ac mains-fed thyristor bridge is feeding a $440V$ dc, $15kW, 1500rpm$ separately excited dc motor with ripple-free continuous current in the dc link under all operating conditions. Neglecting the losses, the power factor of the ac mains at half the rated speed is:

a) 0.354
b) 0.372
c) 0.90
d) 0.955

44) A single-phase, 230 V, 50 Hz ac mains-fed step-down transformer [4 : 1] is supplying power to a half-wave uncontrolled ac-dc converter used for charging a battery $[12Vdc]$ with a series current limiting resistor being 19.04Ω. The charging current is:

a) $2.43A$
b) $1.65A$
c) $1.22A$
d) $1.0A$

45) A three-phase synchronous motor connected to ac mains is running at full load and unity power factor. If its shaft load is reduced by half, with the field current held constant, its new power factor will be:

a) unity
b) lagging
c) leading
d) dependent on machine parameters

46) A $100kVA, 415V\,[line]$, star-connected synchronous machine generates rated open circuit voltage of $415V$ at a field current of $15A$. The short-circuit armature current at a field current of $10A$ is equal to the rated armature current. The per unit saturated synchronous reactance is:

a) 1.731
b) 1.5
c) 0.666
d) 0.577

47) A three-phase, three-stack, variable reluctance step motor has 20 poles on each rotor and stator stack. The step angle of this step motor is:

a) $30°$ b) $6°$

c) $9°$ d) $18°$

48) A single-phase $50kVA, 250V/500V$ two-winding transformer has an efficiency of 95% at full load, unity power factor. If it is reconfigured as a $500V/750V$ autotransformer, its efficiency at its new rated load at unity power factor will be:

a) 95.752% b) 97.851%

c) 98.276% d) 99.241%

49) A $230V\,[Phase]\,, 50Hz$, three-phase, 4-wire system has a phase sequence ABC. A unity power-factor load of $4kW$ is connected between phase A and neutral N. It is desired to achieve zero neutral current through the use of a pure inductor and a pure capacitor in the other two phases. The value of the inductor and capacitor is:

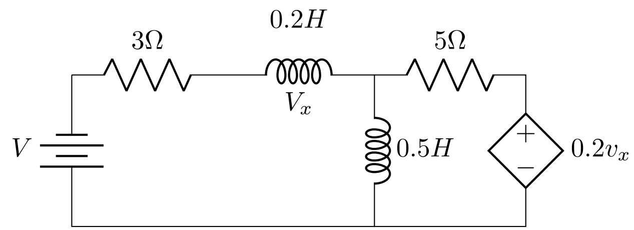
a) $72.95mH$ in phase C and $139.02\mu F$ in phase B

b) $72.95mH$ in phase B and $139.02\mu F$ in phase C

c) $42.12mH$ in phase C and $240.79\mu F$ in phase B

d) $42.12mH$ in phase B and $240.79\mu F$ in phase C

50) The state equation for the current I, shown in the network in terms of the voltage V_x and the independent source V, is given by:



a) $\frac{dI}{dt} = -1.4V_x - 3.75I + V$ b) $\frac{dI}{dt} = 1.4V_x - 3.75I - V$

c) $\frac{dI}{dt} = -1.4V_x + 3.75I + V$ d) $\frac{dI}{dt} = -1.4V_x + 3.75I - V$

51) If $u(t)$, $r(t)$ denote the unit step and unit ramp functions respectively, and $u(t) * r(t)$ their convolution, then the function $u(t+1) * u(t-2)$ is given by:

a) $\frac{1}{2}(t+1)\,u(t+1)\,u(t-2)$ b) $\frac{1}{2}(t-1)\,u(t+1)\,u(t-2)$

c) $\frac{1}{2}(t-1)\,u(t-1)$

d) None of the above