EECS 246
BRANICKY

RECITATION #5

2.52 Write a differential equation description relating the output to the input of the electrical circuit shown in.

(a) Fig. P2.52(a)

PS (b) Fig. P2.52(b)

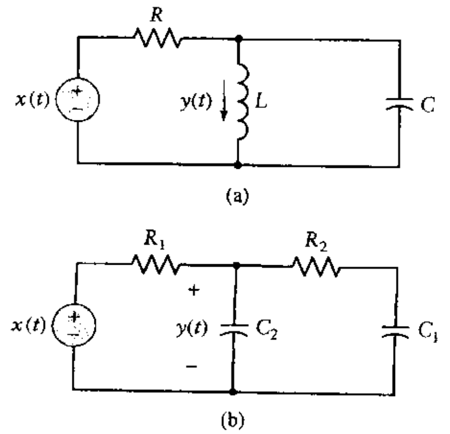

FIGURE P2.52

2.53 Determine the homogeneous solution for the systems described by the following differential equations:

PS (a) $5\frac{d}{dt}y(t) + 10y(t) = 2x(t)$

(b) $\frac{d^2}{dt^2}y(t) + 6\frac{d}{dt}y(t) + 8y(t) = \frac{d}{dt}x(t)$

PS (c) $\frac{d^2}{dt^2}y(t) + 4y(t) = 3\frac{d}{dt}x(t)$

PS (d) $\frac{d^2}{dt^2}y(t) + 2\frac{d}{dt}y(t) + 2y(t) = x(t)$

(e) $\frac{d^2}{dt^2}y(t) + 2\frac{d}{dt}y(t) + y(t) = \frac{d}{dt}x(t)$

2.54 Determine the homogeneous solution for the systems described by the following difference equations:

PS (a) $y[n] - \alpha y[n-1] = 2x[n]$

(b) $y[n] - \frac{1}{4}y[n-1] - \frac{1}{8}y[n-2] = x[n] + x[n-1]$

(c) $y[n] + \frac{9}{16}y[n-2] = x[n-1]$

PS (d) $y[n] + y[n-1] + \frac{1}{4}y[n-2] = x[n] + 2x[n-1]$

2.55 Determine a particular solution for the systems described by the following differential equations, for the given inputs:

PS (a) $5\frac{d}{dt}y(t) + 10y(t) = 2x(t)$

(i) $x(t) = 2$

(ii) $x(t) = e^{-t}$

(iii) $x(t) = \cos(3t)$

PS (b) $\frac{d^2}{dt^2}y(t) + 4y(t) = 3\frac{d}{dt}x(t)$

(i) $x(t) = t$

(ii) $x(t) = e^{-t}$

× (iii) $x(t) = (\cos(t) + \sin(t))$

(c) $\frac{d^2}{dt^2}y(t) + 2\frac{d}{dt}y(t) + y(t) = \frac{d}{dt}x(t)$

(i) $x(t) = e^{-3t}u(t)$

(ii) $x(t) = 2e^{-t}u(t)$

(iii) $x(t) = 2\sin(t)$

2.56 Determine a particular solution for the systems described by the following difference equations, for the given inputs:

PS (a) $y[n] - \frac{2}{5}y[n-1] = 2x[n]$

(i) $x[n] = 2u[n]$

(ii) $x[n] = -\left(\frac{1}{2}\right)^n u[n]$

× (iii) $x[n] = \cos\left(\frac{\pi}{5}n\right)$

(b) $y[n] - \frac{1}{4}y[n-1] - \frac{1}{8}y[n-2] = x[n] + x[n-1]$

(i) $x[n] = nu[n]$

(ii) $x[n] = \left(\frac{1}{8}\right)^n u[n]$

(iii) $x[n] = e^{j\frac{\pi}{4}n}u[n]$

(iv) $x[n] = \left(\frac{1}{2}\right)^n u[n]$

(c) $y[n] + y[n-1] + \frac{1}{2}y[n-2] = x[n] + 2x[n-1]$

(i) $x[n] = u[n]$

(ii) $x[n] = \left(\frac{-1}{2}\right)^n u[n]$

2.59 Determine the output of the systems described by the following difference equations with input and initial conditions as specified:

(a) $y[n] - \frac{1}{2}y[n-1] = 2x[n]$,
$y[-1] = 3, x[n] = \left(\frac{-1}{2}\right)^n u[n]$

(b) $y[n] - \frac{1}{9}y[n-2] = x[n-1]$,
$y[-1] = 1, y[-2] = 0, x[n] = u[n]$

(c) $y[n] + \frac{1}{4}y[n-1] - \frac{1}{8}y[n-2] = x[n] + x[n-1]$,
$y[-1] = 4, y[-2] = -2, x[n] = (-1)^n u[n]$

PS (d) $y[n] - \frac{3}{4}y[n-1] + \frac{1}{8}y[n-2] = 2x[n]$,
$y[-1] = 1, y[-2] = -1, x[n] = 2u[n]$

2.65 Find difference-equation descriptions for the three systems depicted in Fig. P2.65.

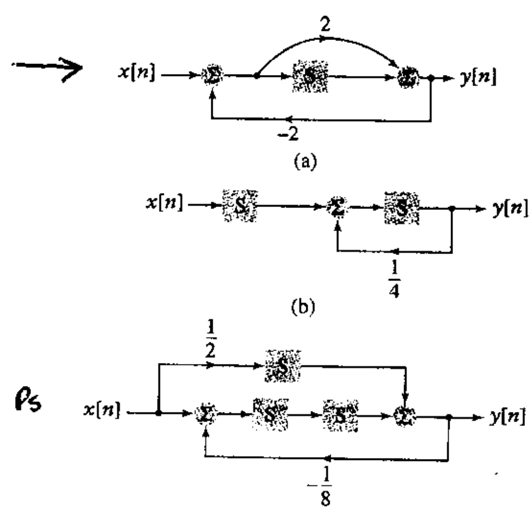

FIGURE P2.65

2.68 Find differential-equation descriptions for the two systems depicted in Fig. P2.68.

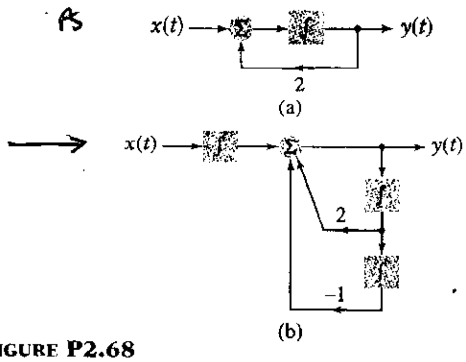

FIGURE P2.68

2.69 Determine a state-variable description for the four discrete-time systems depicted in Fig. P2.69.

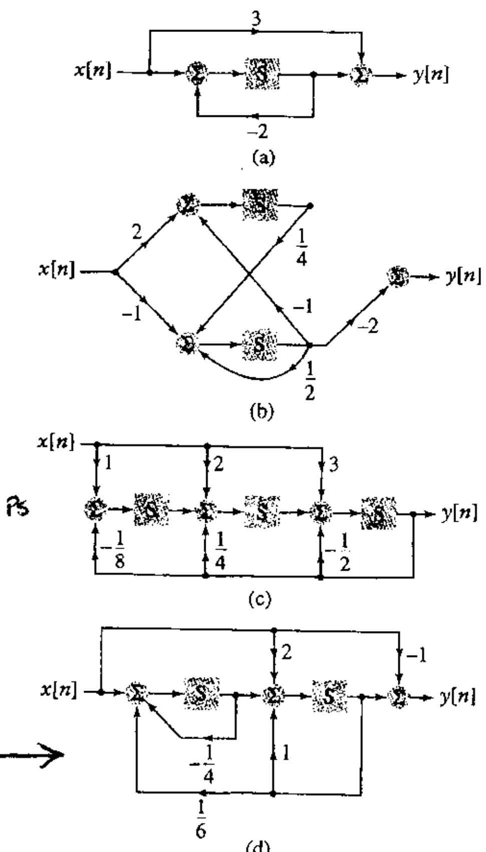

FIGURE P2.69

2.71 Determine a state-variable description for the five continuous-time LTI systems depicted in Fig. P2.71.

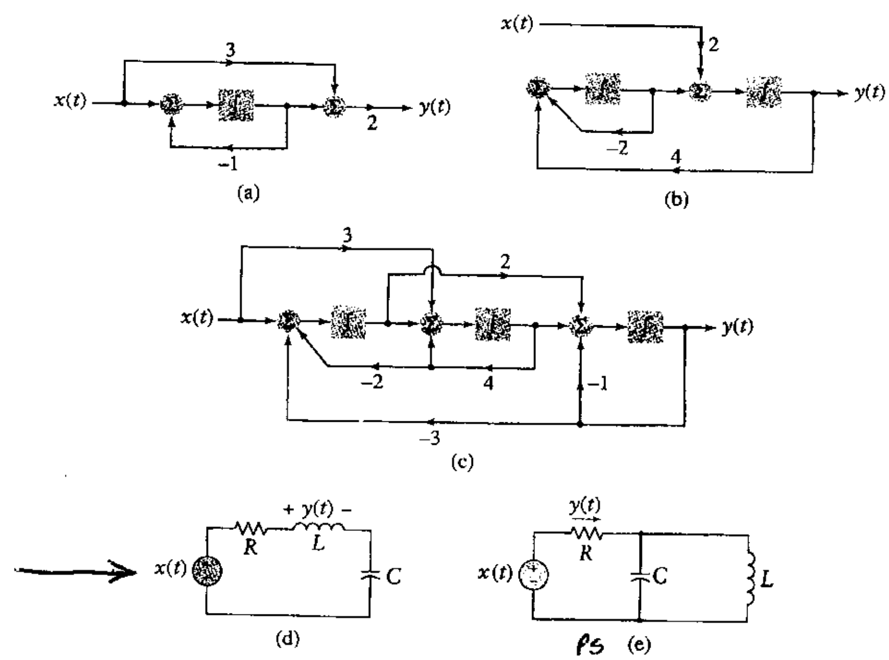

FIGURE P2.71