ECE 8440 Spring 2017
Homework 3: Due Wed, Mar 8

5.48
6.23
6.24

For (a) and (b):

- Determine the transpose of each given signal-flow graph.
- Indicate a correct order of node computations for the original.
- Show your answer directly on the signal-flow graph.
  (Introducing new nodes at the output of a delay unit if that delay unit feeds a summation node).

For (c) and (d):

- Determine the transpose of each given signal-flow graph.
- Verify that the original and transpose have the same transfer function using Mason's Rule.
- As for (a) and (b) indicate the correct order of node computations.

6.26

5.48. Figure P5.48-1 shows the pole–zero plots for three different causal LTI systems with real impulse responses. Indicate which of the following properties apply to each of the systems pictured: stable, IIR, FIR, minimum phase, all-pass, generalized linear phase, positive group delay at all ω.

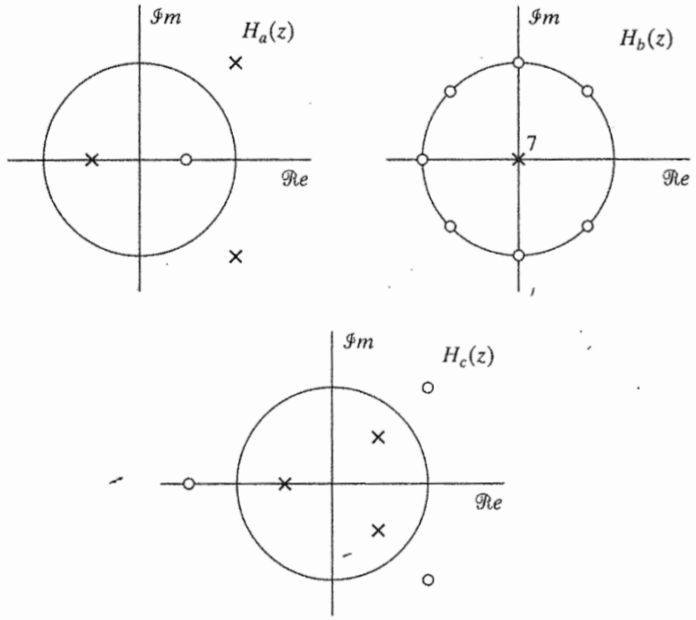


Figure P5.48-1

6.23. Consider a causal linear time-invariant system whose system function is

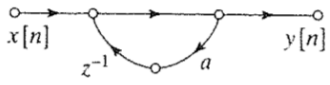
$$H(z) = \frac{1 - \frac{1}{5}z^{-1}}{\left(1 - \frac{1}{2}z^{-1} + \frac{1}{3}z^{-2}\right)\left(1 + \frac{1}{4}z^{-1}\right)}.$$

(a) Draw the signal flow graphs for implementations of the system in each of the following forms:

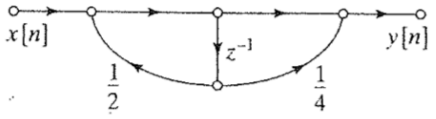
(i) Direct form I
(ii) Direct form II
(iii) Cascade form using first- and second-order direct form II sections
(iv) Parallel form using first- and second-order direct form II sections
(v) Transposed direct form II

(b) Write the difference equations for the flow graph of (v) in Part (a), and show that this system has the correct system function.

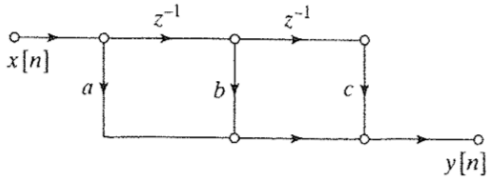
6.24. Several flow graphs are shown in Figure P6.24-1. Determine the transpose of each flow graph, and verify that in each case the original and transposed flow graphs have the same system function.



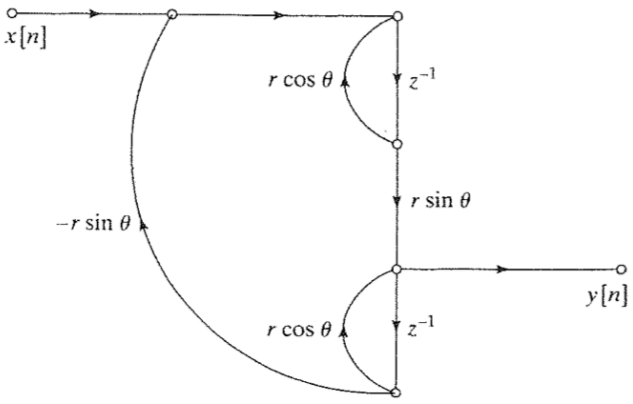
(a)



(b)



(c)



6.26. A linear time-invariant system with system function

$$H(z) = \frac{0.2(1+z^{-1})^6}{\left(1-2z^{-1}+\frac{7}{8}z^{-2}\right)\left(1+z^{-1}+\frac{1}{2}z^{-2}\right)\left(1-\frac{1}{2}z^{-1}+z^{-2}\right)}$$

is to be implemented using a flow graph of the form shown in Figure P6.26-1.

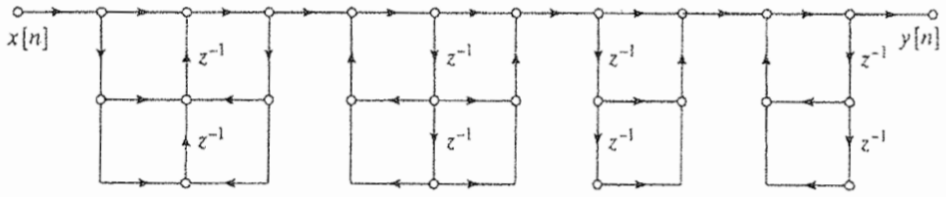


Figure P6.26-1

(a) Fill in all the coefficients in the diagram of Figure P6.26-1. Is your solution unique?

(b) Define appropriate node variables in Figure P6.26-1, and write the set of difference equations that is represented by the flow graph.