5.7   Problems

1. A particular discrete-time system can be represented by the following difference equation:

$$y[n] + \frac{1}{2}y[n-1] - \frac{3}{16}y[n-2] \quad = \quad x[n] + x[n-1] + \frac{1}{4}x[n-2]$$

For this system:

   (a) Determine the impulse response.

   (b) Using a signal flow graph, draw the direct form I structure.

   (c) Using a signal flow graph, draw the direct form II structure.

   (d) Using a signal flow graph, draw the transposed direct form II structure.

   (e) Using a signal flow graph, draw a cascade structure using first-order direct form II sections.

   (f) Using a signal flow graph, draw a parallel structure using first-order direct form II sections.

2. A particular discrete-time system can be represented by the following difference equation:

$$y[n] - 0.5y[n-1] + 0.1y[n-2] + 0.3y[n-3] - 0.0936y[n-4] \quad =$$

$$5x[n] + 16.5x[n-1] + 14.7x[n-2] - 22.04x[n-3] - 33.6x[n-4]$$

For this system:

   (a) Determine the real-valued impulse response. Although this system has complex-valued poles, your answer should not contain any imaginary values.

   (b) Using a signal flow graph, draw the direct form I structure.

   (c) Using a signal flow graph, draw the direct form II structure.

   (d) Using a signal flow graph, draw the transposed direct form II structure.

   (e) Using a signal flow graph, draw a cascade structure using second-order direct form II sections. Make sure your system does not require any complex multiplications.

   (f) Using a signal flow graph, draw a parallel structure using second-order direct form II sections. Make sure your system does not require any complex multiplications.