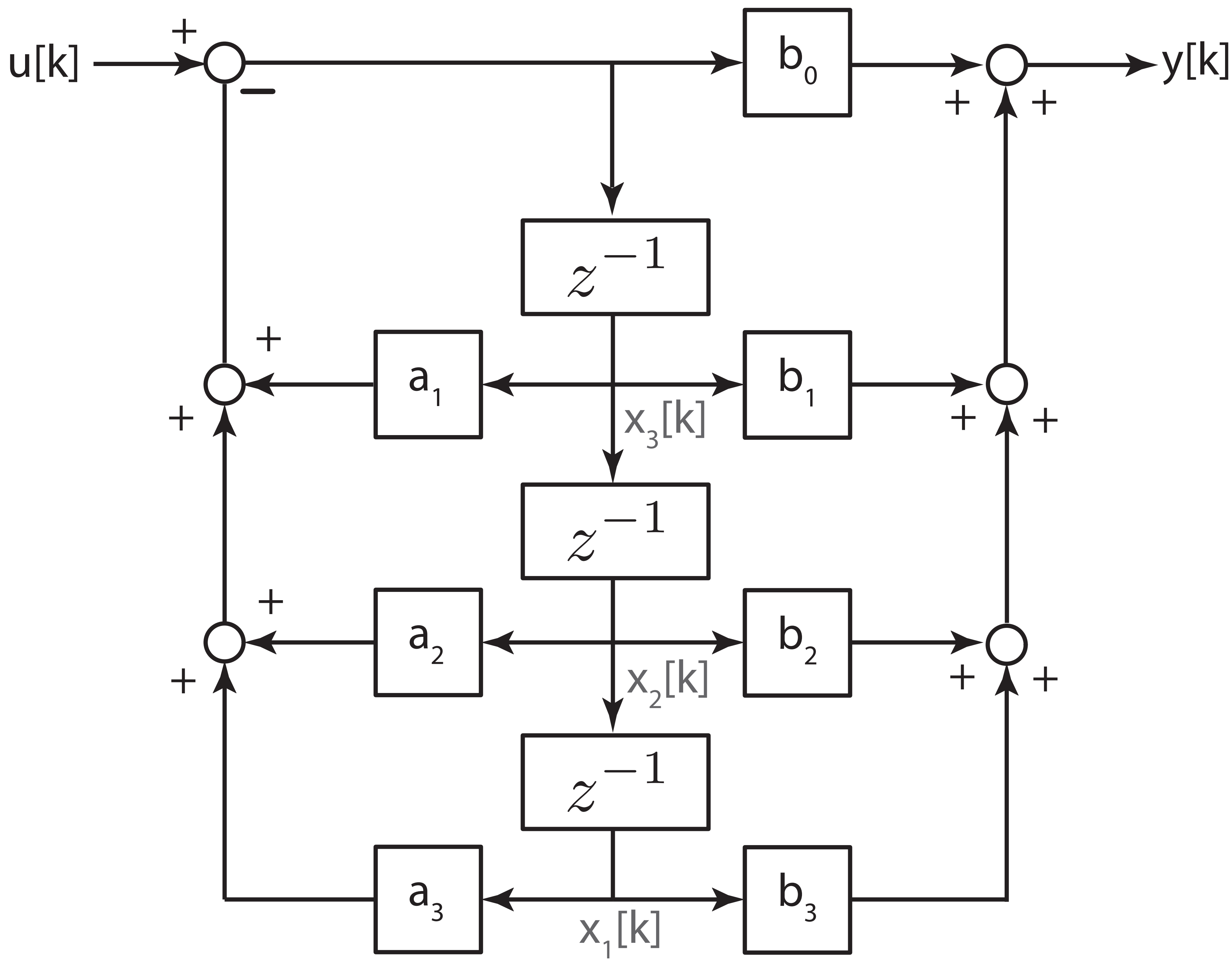
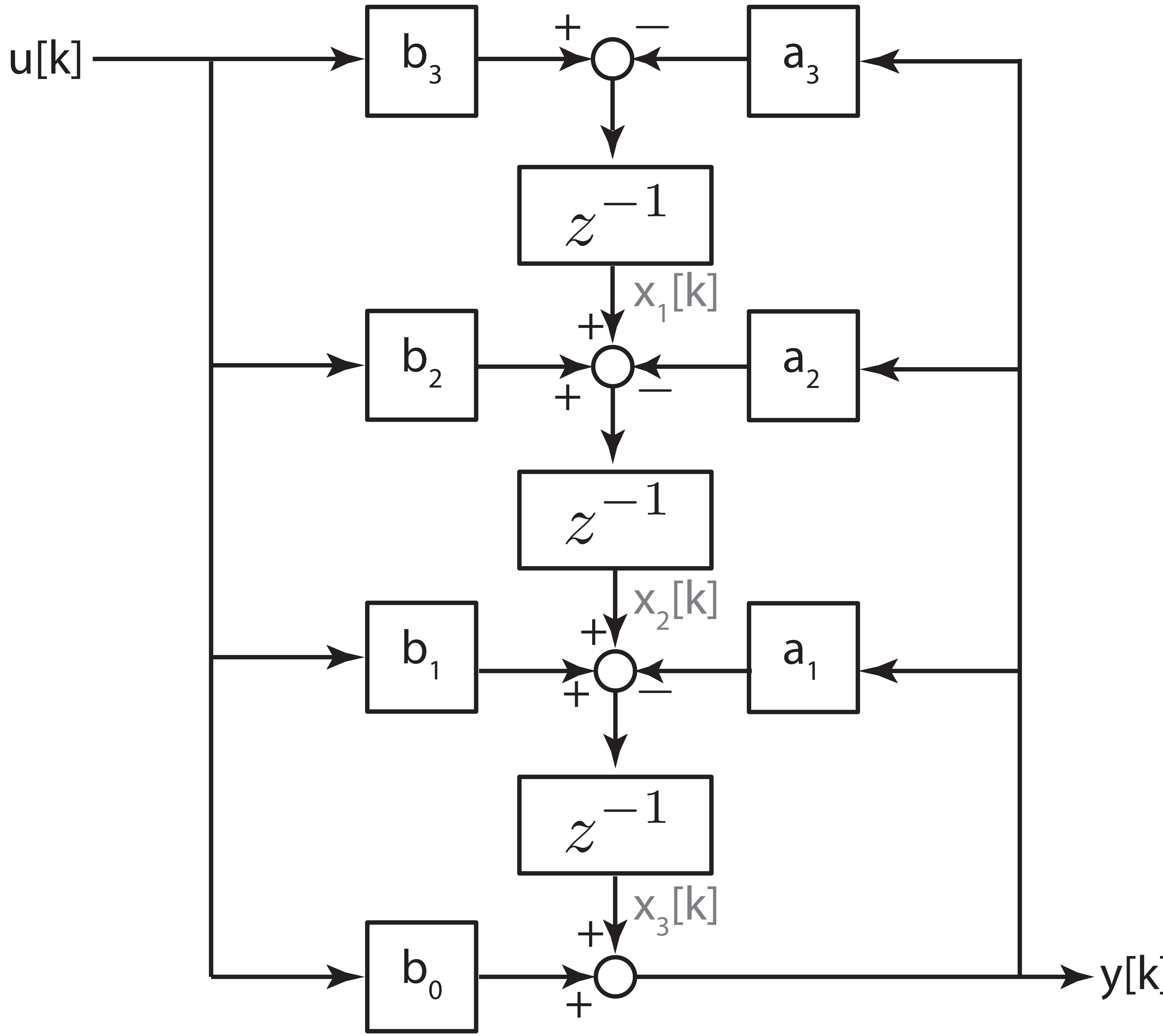

u[k]
y[k]
+
−
b_0
z^{-1}
a_1
b_1
$x_3[k]$
z^{-1}
a_2
b_2
$x_2[k]$
z^{-1}
a_3
b_3
$x_1[k]$

Reachable Canonical Form

$$A = \begin{bmatrix} 0 & 1 & 0 & \cdots & 0 \\ 0 & 0 & 1 & \cdots & 0 \\ \vdots & \vdots & \vdots & & \vdots \\ 0 & 0 & 0 & \cdots & 1 \\ -a_n & -a_{n-1} & -a_{n-2} & \cdots & -a_1 \end{bmatrix} \quad , \quad B = \begin{bmatrix} 0 \\ 0 \\ \vdots \\ 0 \\ 1 \end{bmatrix}$$

$$C = \begin{bmatrix} (b_n - b_0 a_n) & (b_{n-1} - b_0 a_{n-1}) & \cdots & (b_2 - b_0 a_2) & (b_1 - b_0 a_1) \end{bmatrix}$$

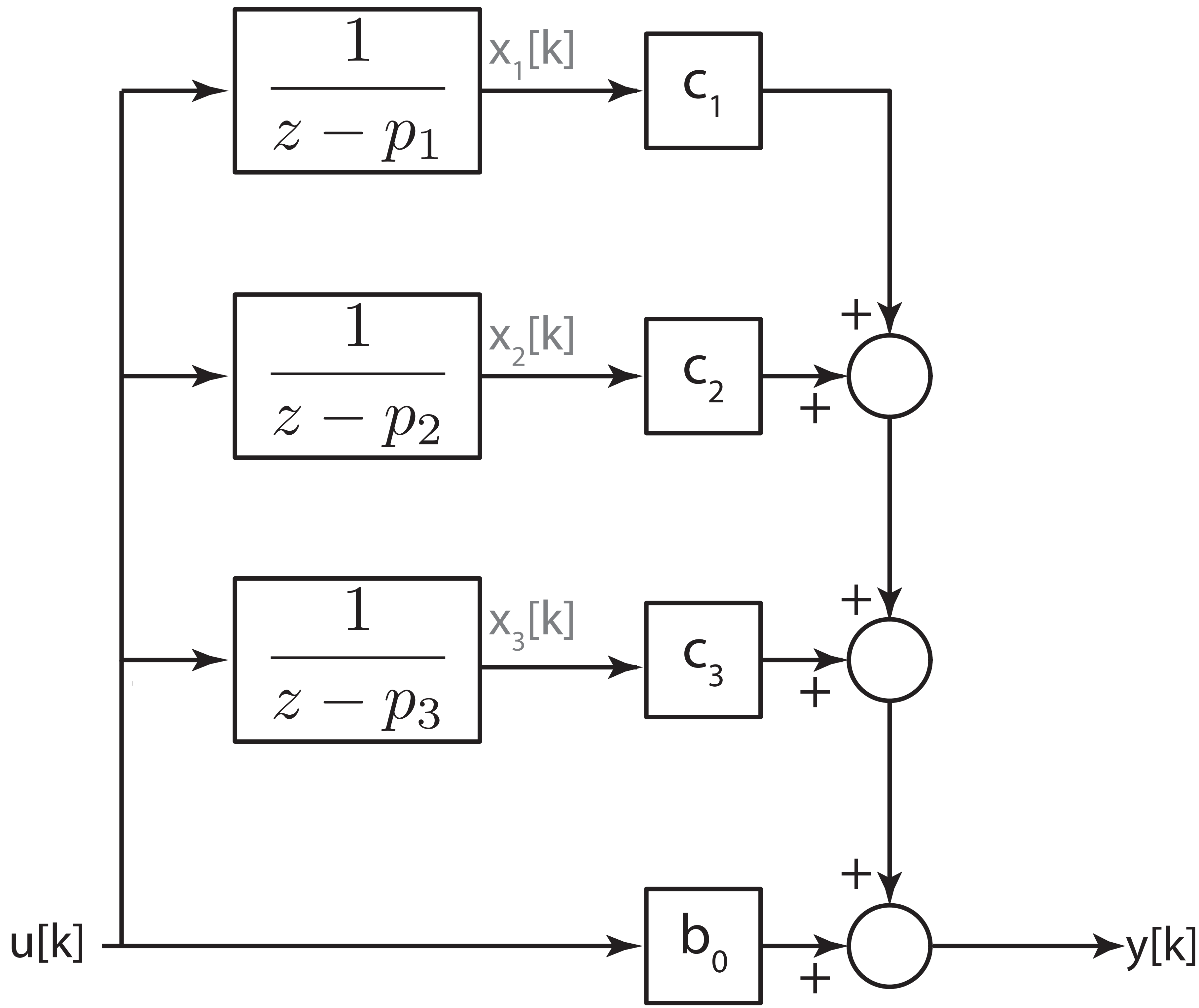
$$D = b_0$$


u[k]
b3
a3
+
−
z−1
x1[k]
b2
a2
+
+
−
z−1
x2[k]
b1
a1
+
+
−
z−1
x3[k]
b0
+
+
y[k]

Observable Canonical Form

$$A = \begin{bmatrix} 0 & 0 & \cdots & 0 & -a_n \\ 1 & 0 & \cdots & 0 & -a_{n-1} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ 0 & 0 & \cdots & 0 & -a_2 \\ 0 & 0 & \cdots & 1 & -a_1 \end{bmatrix} \quad , \quad B = \begin{bmatrix} (b_n - b_0 a_n) \\ (b_{n-1} - b_0 a_{n-1}) \\ \vdots \\ (b_2 - b_0 a_2) \\ (b_1 - b_0 a_1) \end{bmatrix}$$

$$C = \begin{bmatrix} 0 & 0 & \cdots & 0 & 1 \end{bmatrix} \quad , \quad D = b_0$$

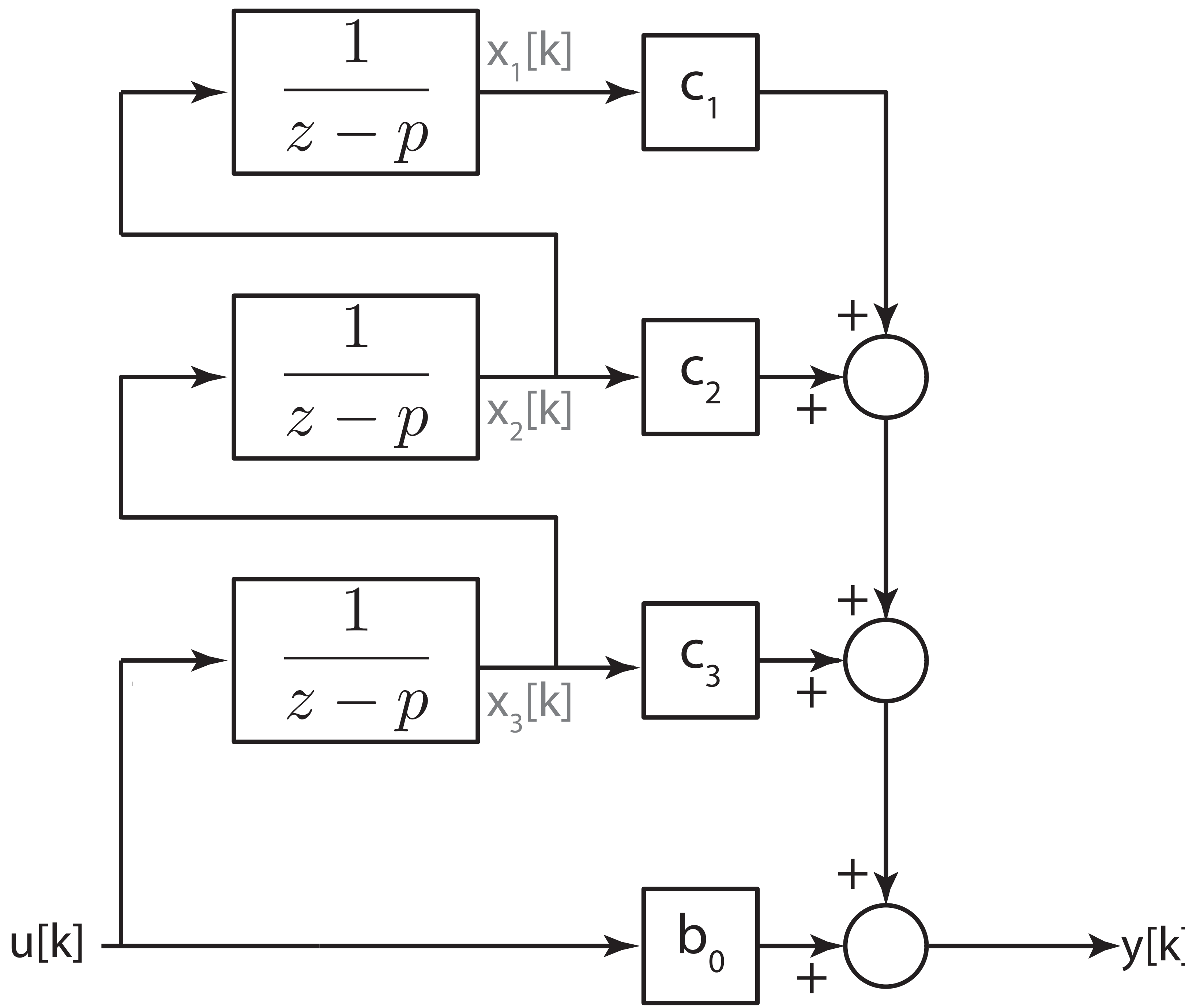


1/(z − p1)
1/(z − p2)
1/(z − p3)
x1[k]
x2[k]
x3[k]
c1
c2
c3
b0
u[k]
y[k]
+

Diagonal Canonical Form

$$A = \begin{bmatrix} p_1 & 0 & \cdots & 0 & 0 \\ 0 & p_2 & \cdots & 0 & 0 \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ 0 & 0 & \cdots & p_{n-1} & 0 \\ 0 & 0 & \cdots & 0 & p_n \end{bmatrix} \quad , \quad B = \begin{bmatrix} 1 \\ 1 \\ \vdots \\ 1 \\ 1 \end{bmatrix}$$

$$C = \begin{bmatrix} c_1 & c_2 & \cdots & c_{n-1} & c_n \end{bmatrix} \quad , \quad D = b_0$$



$\frac{1}{z-p}$
$x_1[k]$
c_1
$\frac{1}{z-p}$
$x_2[k]$
c_2
$\frac{1}{z-p}$
$x_3[k]$
c_3
u[k]
b_0
y[k]
+
+
+
+
+
+

Jordan Canonical Form

$$
A = \left[\begin{array}{c|ccccc|c}
\ddots & & & & & & \\
\hline
& \bar{p} & 1 & \cdots & 0 & 0 & \\
& 0 & \bar{p} & \cdots & 0 & 0 & \\
& & & \ddots & & & \\
& 0 & 0 & \cdots & \bar{p} & 1 & \\
& 0 & 0 & \cdots & 0 & \bar{p} & \\
\hline
& & & & & & \ddots
\end{array}\right], \quad B = \left[\begin{array}{c}
\vdots \\
\hline
0 \\
0 \\
\vdots \\
0 \\
1 \\
\hline
\vdots
\end{array}\right]
$$

$$
C = \left[\begin{array}{c|ccccc|c} \cdots & c_1 & c_2 & \cdots & c_{n-1} & c_n & \cdots \end{array}\right]
$$