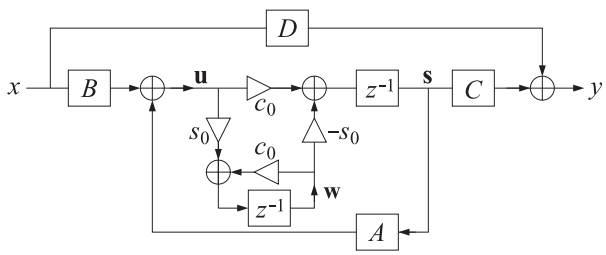
Frequency-Shifted State-Space Form



Sample processing algorithm:

for each input sample x do:

$$y = [C_1, C_2]\begin{bmatrix} s_1 \\ s_2 \end{bmatrix} + Dx$$

$$\begin{bmatrix} u_1 \\ u_2 \end{bmatrix} = \begin{bmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{bmatrix}\begin{bmatrix} s_1 \\ s_2 \end{bmatrix} + \begin{bmatrix} B_1 \\ B_2 \end{bmatrix} x$$

$$\begin{bmatrix} s_1 \\ s_2 \end{bmatrix} = c_0 \begin{bmatrix} u_1 \\ u_2 \end{bmatrix} - s_0 \begin{bmatrix} w_1 \\ w_2 \end{bmatrix}$$

$$\begin{bmatrix} w_1 \\ w_2 \end{bmatrix} = c_0 \begin{bmatrix} u_1 \\ u_2 \end{bmatrix} + s_0 \begin{bmatrix} w_1 \\ w_2 \end{bmatrix}$$

where

$$A = \begin{bmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{bmatrix}, \quad B = \begin{bmatrix} B_1 \\ B_2 \end{bmatrix}, \quad C = [C_1, C_2], \quad D = \text{scalar}$$

$$\mathbf{s} = \begin{bmatrix} s_1 \\ s_2 \end{bmatrix}, \quad \mathbf{w} = \begin{bmatrix} w_1 \\ w_2 \end{bmatrix}, \quad \mathbf{u} = \begin{bmatrix} u_1 \\ u_2 \end{bmatrix}$$