

① time domain

$$x[n] = [1 \ 2 \ 3 \ \dots \ 7 \ -3 \ \dots]$$

$$h[n] = [-1 \ \dots \ 3 \ \dots \ 2 \ \dots \ -1]$$

$$y[n] = x[n] * h[n]$$

Suppose

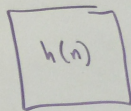
$$h[-1] = 1$$

$$h[0] = 3$$

$$h[1] = 1$$

How would you handle a non-causal system?
(in matlab)

Ask Christian!



② transfer function

$$\Rightarrow \text{Z-transform: } H(z) = \frac{b_0 + b_1 z^{-1} + b_2 z^{-2} + \dots + b_m z^{-m}}{a_0 + a_1 z^{-1} + a_2 z^{-2} + \dots + a_n z^{-n}}$$

③ difference equations:

$$\frac{Y(z)}{X(z)} = \frac{b_0 + b_1 z^{-1} + b_2 z^{-2}}{a_0 + a_1 z^{-1} + a_2 z^{-2}}$$

$$Y(z) (a_0 + a_1 z^{-1} + a_2 z^{-2}) = X(z) (b_0 + b_1 z^{-1} + b_2 z^{-2})$$

$$Y(z) a_0 = -a_1 z^{-1} Y(z) - a_2 z^{-2} Y(z) + b_0 X(z) + b_1 X(z) z^{-1} + b_2 z^{-2} X(z)$$

Inverse Z-transform:

$$a_0 y(n) = -a_1 y(n-1) - a_2 y(n-2) + b_0 x(n) + b_1 x(n-1) + b_2 x(n-2)$$