ECE-539, SPRING 2010

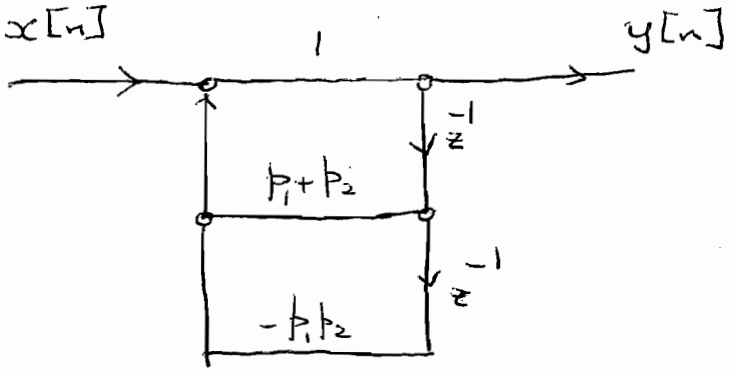
DIGITAL SIGNAL PROCESSING

Example: Transposed Direct Form

Consider the causal and stable all-pole LTI system:

$$H(z) = \frac{1}{(1-p_1 z^{-1})(1-p_2 z^{-1})}, \quad |z| > \max\{|p_1|, |p_2|\}$$

The type-II direct form structure is

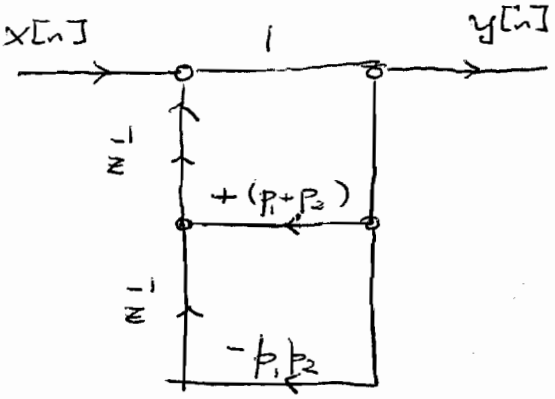


Following the algorithm for obtaining the transposed form

(a) Reverse direction of arrows

(b) Exchange input with output

Transposed Form



Note that the only difference is that the delay and multiplier are switched around.

There are two non-touching loops in both structures with loop gains of $(p_1+p_2)z^{-1}$ and $(-p_1p_2)z^{-2}$

Using Mason's Gain formula:

$$H(z) = \frac{1}{1-\left((p_1+p_2)z^{-1} - p_1p_2z^{-2}\right)}$$

in either structure.