Lecture 13 – Generators and Recursion

## Summary

- Generator or Recursion form of LTI difference equation

- Separate into simpler parts to find output:

- Zero Input Solution: Find y[n] using only initial conditions (pretend input is zero)

- Zero State Solution: Find y[n] using only input (pretend initial conditions are zero)

- Recursion loop for h[n]: impulse response

- Begin flow diagrams for LTI systems

## LTI System Traits

- LTI System is causal if:

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- LTI System is F.I.R. if:

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- Example LTI Difference Eq

- (System Order)

## Generator or Recursion Form

- Can be used in “recursion loop” to solve for each “new” value of y[n], as we increase “n” value, given past “N” values of y[n] & knowing formula or ordered list for input signal

Example from P.2 in generator (recursion) form:

(known)

(known)

Assume x[n] is known (ordered list or formula)

Can start at n = 0 for “n” from 0 to “n”:

End Loop!

## Separation

- Separating “solution” of LTI difference equation into:

- Zero-Input part (only use ICs)

- Recursion form:

- Zero-State part (only use inputs)

- Recursion form:

- Total:

## Impulse Response

- Impulse Response is a special case of zero-state

- LTI Example

## Flow Diagrams

- For Distance Time Systems:

- Flow diagrams use “delay” element

- Delay elements are fictional concepts, not real devices

- Delay is the act of transferring data from input of the register to output of the register on the active edge of the clock signal

- F.I.R. systems are easiest to map from difference equation to flow diagram

- Impulse response is the one that replaces y with h and x with

- Direct Form

\*find the notes for this because I’m not drawing shit\*