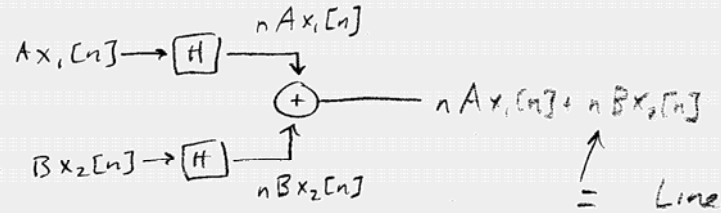
① Text 5-3

$y[n] = n\,x[n]$

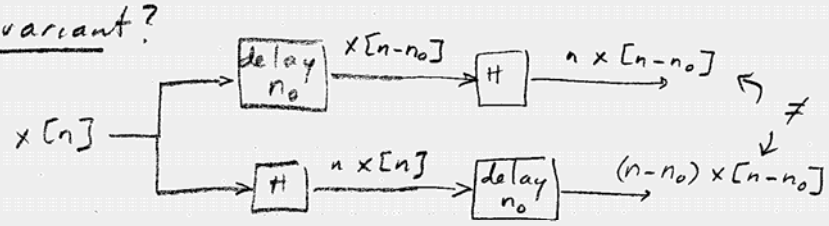
<u>linear?</u>



$=$ <u>Linear</u>

$Ax_1[n] + Bx_2[n] \longrightarrow \boxed{H} \longrightarrow n(Ax_1[n] + Bx_2[n])$

<u>time Invariant?</u>



$\neq$

not time <u>invariant</u>

(time varying)

<u>static</u>?

output at any time n_0 only depends on input at time n_0 $\Rightarrow$ <u>static</u>

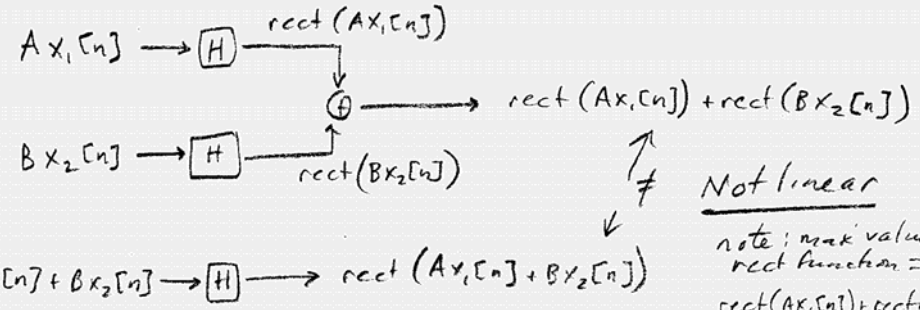
$y[n_0] = n_0\,x[n_0]$

---

② Text 5-5

$y[n] = \mathrm{rect}(x[n])$ note: this is the continuous rect( ) function.

<u>linear?</u>

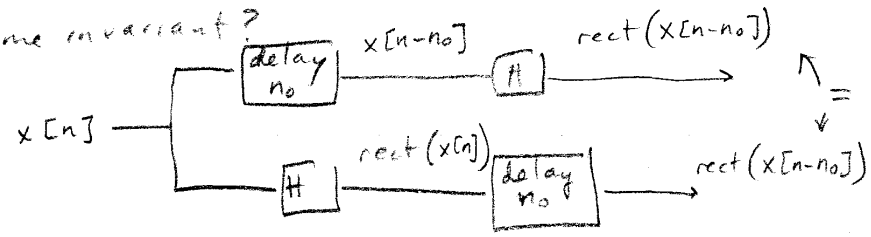


$\neq$ <u>Not linear</u>

$Ax_1[n] + Bx_2[n] \longrightarrow \boxed{H} \longrightarrow \mathrm{rect}(Ax_1[n] + Bx_2[n])$

note: max value of rect function $= 1$, but $\mathrm{rect}(Ax_1[n]) + \mathrm{rect}(Bx_2[n])$ can be equal to 2

time invariant?



noninvertible? <u>No</u>

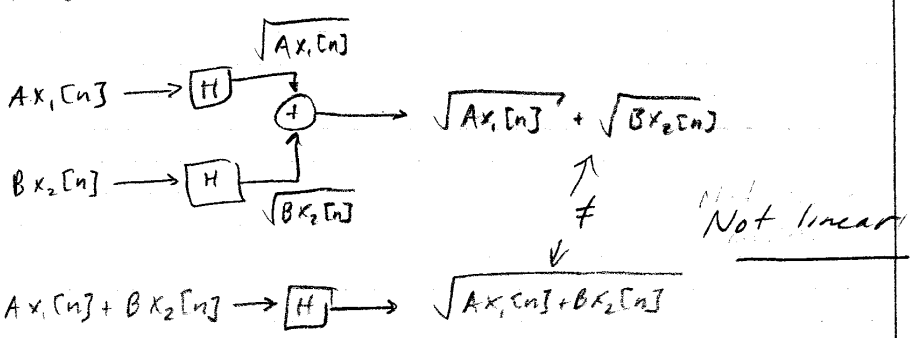
counterexample:

if $y[n]=1$, any value of $x[n]$ between $x[n]=-\frac{1}{2}$ to $x[n]=\frac{1}{2}$ will cause output $=1$, so unique inputs <u>do not</u> result in unique outputs

(3) Text 5-12

$y[n] = \sqrt{x[n]}$

<u>Linear?</u>



<u>BIBO stable?</u> Assume $|x[n]| < M < \infty$

then $|y[n]| = |\sqrt{x[n]}| < \sqrt{M} < \infty$

Bounded inputs result in bounded outputs. <u>Bibo stable</u>

memory?

static (memoryless) output at any time n_0 only depends on input at same time

$$y[n_0] = \sqrt{x[n_0]}$$

Invertible?

$$y[n] = \sqrt{x[n]}$$

so $(y[n])^2 = x[n]$

Given any output value, there is a unique input that produced that output: given output $y[n_0]$,

$$x[n_0] = (y[n_0])^2$$