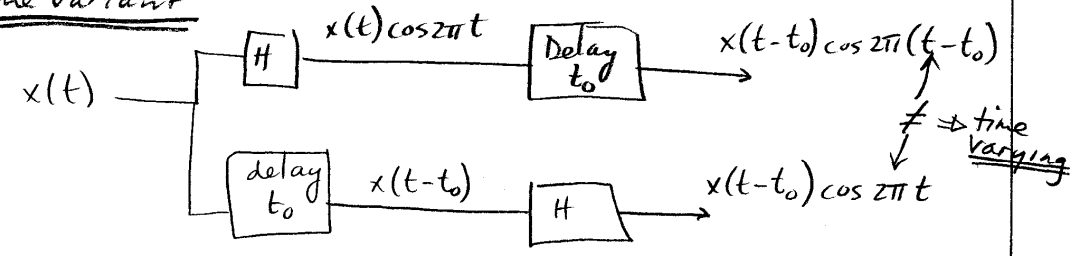
(1) Text 4-9

$y(t) = x(t) \cos 2\pi t$

<u>time variant</u>



<u>BIBO stable</u>

assume $|x(t)| < M < \infty$

then $|y(t)| = |x(t) \cos 2\pi t| < |x(t)| \cdot 1 = M < \infty$

so

$|y(t)| < M < \infty$

BIBO stable

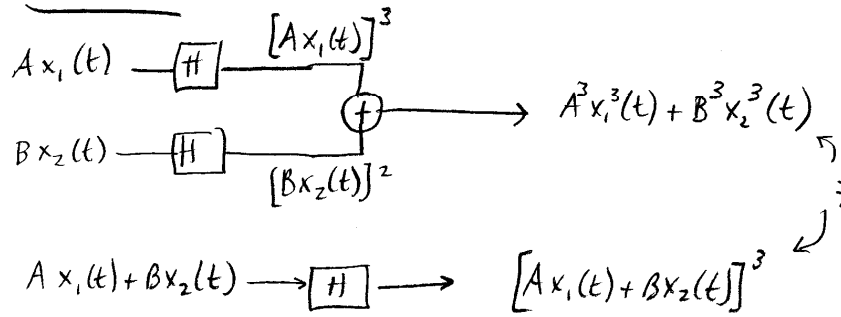
<u>Non Invertible</u>

counter example: when $\cos 2\pi t = 0$, any value of $x(t)$ will result in $y(t) = 0$, so the unique relationship between x and y is lost.

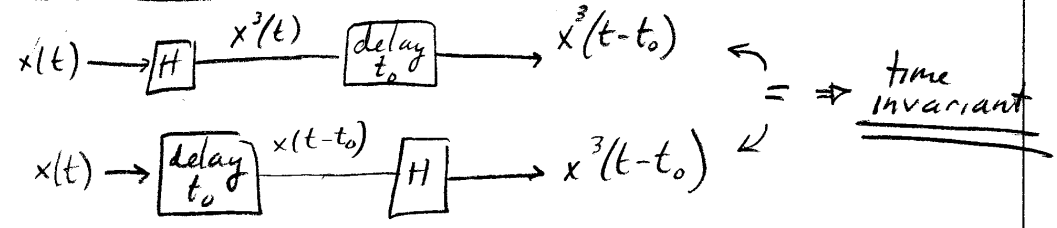
(2) Text 4-18

$$y(t) = [x(t)]^3$$

linear?



time invariant?



BIBO stable?

assume $|x(t)| < M < \infty$

then $|y(t)| = |x^3(t)| < M^3 < \infty \Rightarrow$ BIBO stable

causal?

Causal - output only depends on current value of input (no future inputs)

Memory?

Memoryless - output only depends on current input (no past values.)

invertible?

Invertible - for any value of $y(t)$, there is only one $x(t)$ that could have produced it (assuming input is real valued)

(3) $y(t) = 2t \cdot x(t) + 3$

BIBO stable?

Assume $|x(t)| < M < \infty$

then $|y(t)| = |2t \cdot x(t) + 3|$

$< 2|t| M + 3$

but if $t = +\infty$ or $-\infty$, output $= \infty$
so even if $x(t)$ is bounded, output is unbounded. <u>NOT BIBO Stable</u>

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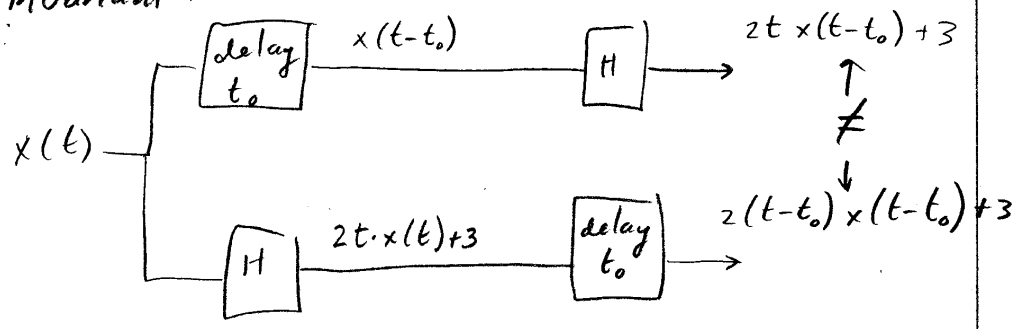
time invariant?



2 outputs not equal $\Rightarrow$ NOT TIME INVARIANT.