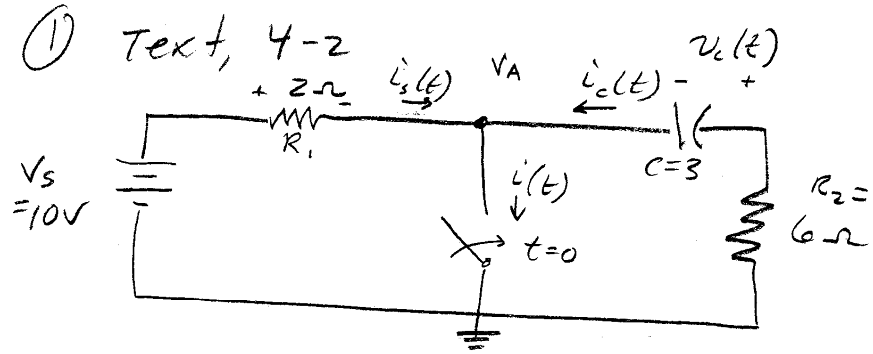
(1) Text, 4-2



<u>what we know when switch closes</u>

$$i(t) = i_s(t) + i_c(t)$$

$$i_s(t) = \frac{V_s}{R_1}$$

$$i_c(t) = C\,\frac{dv_c(t)}{dt}$$

$$v_c(t) + i_c(t)\cdot R_2 = 0 = v_c(t) + R_2C\,\frac{dv_c(t)}{dt}$$

$$v_c(t) + R_2C\,\frac{dv_c(t)}{dt} = 0$$ has a solution of the form $v_c(t) = Ke^{-\alpha t}$

$$= Ke^{-\frac{t}{R_2C}} = Ke^{-t}$$

at $t=0$, $v_c(0) = -10 = Ke^{-0/R_2C} = K$

so $K = -10$

$$v_c(t) = -10e^{-\frac{t}{18}}$$

$$i_c(t) = i(t) - i_s(t) = \frac{V_s}{R_1} - C\,\frac{dv_c(t)}{dt}$$

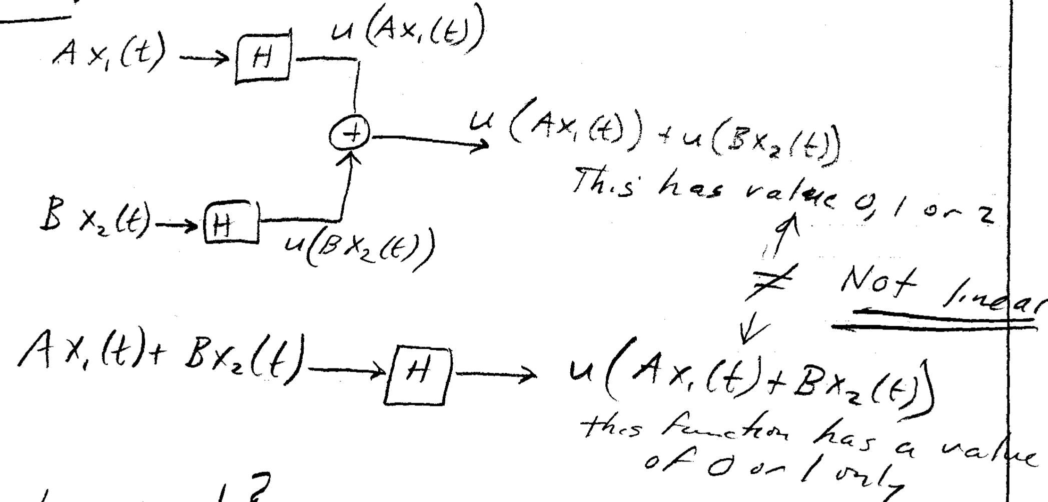
$$= 5 - 3\left(-10\cdot\left(-\tfrac{1}{18}\right)e^{-t/18}\right)$$

$$\boxed{i_o(t) = 5 - 5/3\, e^{-t/18}\ A}$$

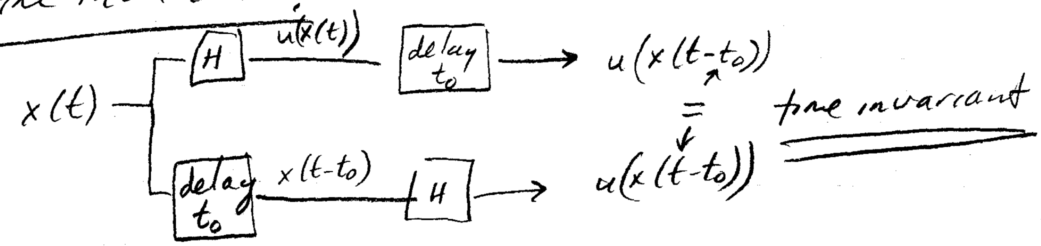
② Text, 4-6

$y(t) = u(x(t))$

Linear?



time Invariant?



stable?

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

Then $|y(t)| = |u(x(t))| < u(M) < \infty$ (always = 0 or 1)

stable

Invertible?

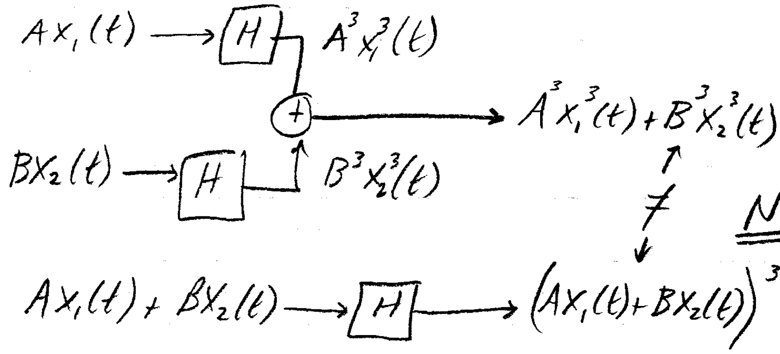
- the output is either 0 or 1
- there are an infinite number of input values that could produce 0, and an infinite number of values that could produce 1

∴ **Not invertible**

3 Text 4-18

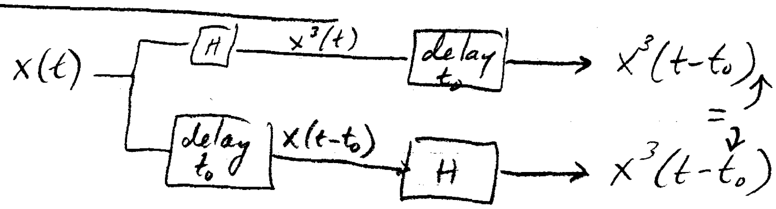
$$y(t) = x^3(t)$$

Linearity:



Not Linear

Time Invariance



Time Invariant

BIBO stability

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

Then $|y(t)| = |x^3(t)| < M^3 < \infty$

$\therefore$ **BIBO Stable**

Causality

output at any time t_0 only depends on input at t_0, no future values $\Rightarrow$ **causal**

Memory output at any time t_0 only depend on input at t_0, no past or future values $\Rightarrow$ **Memoryless**

Invertibility - $y(t) = x^3(t) \rightarrow x(t) = \sqrt[3]{y(t)}$ **invertible**