Xilinx Zynq FPGA, TI DSP, MCU 기반의 프로그래밍 및 회로 설계 전문가 과정

#58

강사:Innova Lee(이 상훈)
학생: 김시윤

라플라스 변환

$e^{at} = \frac{1}{s-a}$　　$\cos at = \frac{s}{s^2+a^2}$

$\sin at = \frac{a}{s^2+a^2}$　　$t^n = \frac{n!}{s^{n+1}}$

$u(t-a) = \frac{e^{-as}}{s}$

$x(s-k) = \mathcal{L}(x(t)e^{kt})$

1\. $\mathcal{L}\{f(t)\} = \int_0^\infty e^{-st} f(t)\,dt$

0~∞ 까지 적분이 미적분학에서는 이상적분이라 부른다.

$\lim_{k\to\infty} \int_0^k e^{-st} e^{-at}\,dt$.

$= \lim_{k\to\infty} \int_0^k e^{-(s+a)t}\,dt$

$\lim_{k\to\infty} \left[-\frac{1}{(s+a)} e^{-(s+a)t} \right]_0^k$

$= 0 + \frac{1}{(s+a)}$

2\. $f(t) = \sin(t)$

오일러공식　　$\sin(t) = \frac{e^{it} - e^{-it}}{2i}$

$\cos(t) = \frac{e^{it} + e^{-it}}{2}$

$\mathcal{L}\{f(t)\} = \int_0^\infty e^{-st} \frac{e^{it} - e^{-it}}{2i}\,dt$.

$= \frac{1}{2i} \int_0^\infty e^{-(s-i)t} - e^{-(s+i)t}\,dt$

$= \frac{1}{2i} \left\{ -\frac{1}{(s-i)} \left[e^{-(s-i)t} \right]_0^\infty + \frac{1}{(s+i)} \left[e^{-(s+i)t} \right]_0^\infty \right.$

$= \frac{1}{2i} \left\{ \frac{1}{(s-i)} - \frac{1}{(s+i)} \right\}$

$= \frac{1}{2i} \left\{ \frac{-s+i-s\cancel{+}i}{s^2-1} \right\}$

$= \frac{\cancel{4}\,2i}{2i \times (s^2-1)}$　$= \frac{1}{s^2+1}$

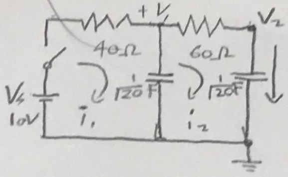
$40I_1(s)s + 120I_1(s) - 120I_2(s) = 10$

$(40s+120)I_1(s) - 120I_2(s) = 10$

$40(s+3)I_1(s) - 120I_2(s) = 10$

$I_1(s) = \frac{10 + 120I_2(s)}{40(s+3)}$

$= \frac{1 + 12I_2(s)}{4(s+3)}$



$q_1(0) = q_2(0) = 0$

↳ 전하량 초기에 스위치가 떨어져있으니 당연히 0이다.

$i_c = C\frac{dv}{dt} \Rightarrow V = \frac{1}{C}\int i\,dt$

$\frac{dq}{dt} = i$

망전류법. (직렬로 흐르는 전류는 동일)

1\. $40i + \frac{1}{c}$

1\. $40i_1 + 120\int(i_1 - i_2)\,dt = 10$

$i_2 = i_1$ C의 충전을 방해

2\. $60i_2 + 120\int i_2\,dt + 120\int(i_2 - i_1)\,dt = 0$.

*적분의 라플라스 변환

$\mathcal{L}\{\int f(t)\,dt\} = \frac{1}{s}F(s)$

각각을 라플라스 변환

1\. $40I_1(s) + \frac{120}{s}\{I_1(s) - I_2(s)\} = \frac{10}{s}$

2\. $60I_2(s) + \frac{120}{s}I_2(s) + \frac{120}{s}\{I_1(s) - I_2(s)\} = 0$.

s들곱(양변)

1\. $40I_1(s)s + 120\{I_1(s) - I_2(s)\} = 10$.

2\. $60I_2(s)s + 120I_2(s) + 120\{I_1(s) - I_2(s)\} = 0$

1\. $40I_1(s)s + 120I_1(s) - 120I_2(s) = 10$

$120I_2(s) = 40I_1(s)s + 120I_1(s) - 10$

$I_2(s) = \frac{40I_1(s)s + 120I_1(s) - 10}{120}$

$I_2(s) = \frac{4I_1(s)s + 12I_1(s) - 1}{12}$

$= \frac{4I_1(s)(s+3) - 1}{12}$

1\. $40I_1(s)s + 120I_1(s) - 120\left(\frac{4I_1(s)(s+3) - 1}{12}\right)$

$= 40I_1(s)s + 120I_1(s) - 10(4I_1(s)(s+3) - 1)$

↳ $-40I_1(s)(s+3) + 10$

↳ $-40I_1(s)s - 120I_1(s) + 10$

2. $60I_2(s)s + 120I_2(s) + 120\{I_1(s) - I_2(s)\} = 0$

$I_1(s) = \dfrac{1+12I_2(s)}{4(s+3)}$

$60I_2(s)s + 120I_2(s) + 120I_1(s) - 120I_2(s) = 0$

$60I_2(s)s + 120I_2(s) + \dfrac{120(1+12I_2(s))}{4(s+3)} - 120I_2(s) = 0$

$\hookrightarrow \dfrac{30(1+12I_2(s))}{s+3}$

$2I_2(s)s + \cancel{4I_2(s)} + \dfrac{(1+12I_2(s))}{s+3} - \cancel{4I_2(s)} = 0$

$2I_2(s)s(s+3) + 1 + 12I_2(s) = 0$

$2s^2I_2(s) + 6sI_2(s) + 12I_2(s) + 1 = 0$

$2I_2(s)(s^2+3s+6) + 1 = 0$

$I_2(s) = -\left(\dfrac{1}{2s^2+6s+12}\right)$

$I_1(s) =$

푸리의 적분

$x_k = a + \Delta x$. , $\Delta x = \dfrac{b-a}{n}$.

주기가 없어도 푸리의 적분을 이용하면
푸리의 급수로 표현가능.

푸리의 급수식

$f(x) = \dfrac{a_0}{2} + \sum_{n=1}^{\infty} \{a_n\cos(\frac{n\pi}{T}x) + b_n\sin(\frac{n\pi}{T}x)\}dx$

주파수(f), 주기(T), ω

$f = \dfrac{1}{T} \leftrightarrow T = \dfrac{1}{f} = \dfrac{2\pi r}{V} = \dfrac{2\pi}{\omega}$

$\omega = 2\pi f = \dfrac{2\pi}{T}$, $V = r\omega$, $\omega = T$

$\Delta\omega$ = ω를 n등분 적분하기 위해.

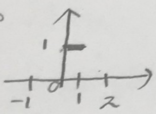
$\omega_n = \omega_{n+1} - \omega_n$

$A_\omega = \frac{1}{\pi}\int_{-\infty}^{\infty} f(p)\cos(\omega p)dp$

$B_\omega = \frac{1}{\pi}\int_{-\infty}^{\infty} f(p)\sin(\omega p)dp$.

$\int_0^\infty (A_\omega\cos(\omega p) + B_\omega\sin(\omega p))d\omega$

문제1



$f(x) = 0 \quad -1 \le x < 0$

$f(x) = 1 \quad 0 \le x < 1$

$f(x) = 0 \quad 1 \le x < 2$.

$A_\omega = \frac{1}{\pi}\int_{-\infty}^{\infty} f(p)\cos(\omega p)dp$.

$= \frac{1}{\pi}\{\int_{-\infty}^{0} 0 + \int_0^1 1\cos(\omega p)dp + \int_1^\infty 0$

$= \frac{1}{\pi}\frac{1}{\omega}[\sin(\omega p)]_0^1$

$= \frac{1}{\omega\pi}\sin(\omega)$

$B_\omega = \frac{1}{\pi}\int_{-\infty}^{\infty} f(p)\sin(\omega p)dp$.

$= \frac{1}{\pi}\int_{-\infty}^{0} 0 + \int_0^1 \sin(\omega p)dp + \int_1^\infty 0$

$= \frac{1}{\pi}[-\frac{1}{\omega}\cos(\omega p)]_0^1$

$= -\frac{1}{\omega\pi}\cos(\omega) + \frac{1}{\omega}$

$\therefore f(x) = \int_0^\infty \frac{1}{\omega\pi}\sin(\omega)\cos(\omega p) - \frac{1}{\omega\pi}\cos(\omega)\sin$

$+ \frac{1}{\omega\pi}\sin(\omega p)\}d\omega$

$= \frac{1}{\omega\pi}\sin(\omega + \omega p)$