Xilinx Zynq FPGA,TI DSP, MCU 기반의 프로그래밍 전문가 과정

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수학

⟨61일차⟩

ex)

$$f(x) = \begin{cases} 0 & (-\pi < x < 0) \\ x & (0 < x < \pi) \end{cases}$$

$$a_0 = \frac{1}{\pi}\int_{-\pi}^{\pi} f(x) = \int_0^{\pi} x\,dx = \left[\frac{1}{2}x^2\right]_0^{\pi} \cdot \frac{1}{\pi} = \boxed{\frac{\pi}{2}}$$

$$a_n = \frac{1}{\pi}\int_{-\pi}^{\pi} f(x)\cos\left(\frac{n\pi x}{\pi}\right)dx = \frac{1}{\pi}\int_0^{\pi} x\cos(nx)\,dx$$

$$\frac{1}{\pi}\int f(x)\cdot g(x) = f(x)g(x) - \int f(x)g'(x)$$

$$\frac{1}{\pi}\int \cos(nx)\cdot x = \frac{1}{n}\sin(nx)\cdot x - \int_0^{\pi}\frac{1}{n}\sin(nx)\,dx$$

$$= \frac{\pi}{n}\sin(n\pi) + \frac{1}{n^2}[\cos(n\pi)]_0^{\pi}$$

$$\frac{1}{\pi}x = \frac{\pi}{n}\sin(n\pi) + \frac{1}{n^2}[\cos(n\pi)-1]$$

→ if) n은 정수면

$$\boxed{a_n = \frac{1}{\pi n^2}[\cos n\pi - 1]}$$

$$b_n = \frac{1}{\pi}\int_{-\pi}^{\pi} f(x)\cdot\sin(n\pi) = \frac{1}{\pi}\int_0^{\pi} x\cdot\sin(nx)\cdot dx$$

if) n=정수 ↳

$$\frac{1}{\pi}\int_0^{\pi}\sin(nx)\cdot x = \frac{1}{\pi}\left(\left[-\frac{1}{n}\cos(nx)\cdot x\right]_0^{\pi} + \int_0^{\pi}\frac{1}{n}\cos(n\pi)\,dx\right) = -\frac{\pi}{n}\cos(n\pi)$$

sin함

$$\boxed{b_n = -\frac{1}{n}\cos(n\pi)}$$

$$f(x) = \frac{\pi}{4} + \sum_{n=1}^{\infty}\left\{\frac{1}{\pi n^2}[\cos(n\pi)-1]\cdot\cos(nx) - \frac{1}{\pi}\cos(n\pi)\cdot\sin(nx)\right\}$$

⟹ $y=x$와 동치 $(x>0)$

파시발 정리 ⟶ 나이키스트 정리

⇓

시간 영역에서

전력 함유량은

주파수 영역상에 푸리에 급수

각 성분의 합과 같다.

〈함수발생기〉

$$\left(\begin{aligned} a_0 &= \frac{1}{T}\int_{-T}^{T} \\ a_n &= \frac{1}{T}\int_{-T}^{T} f(x)\cos\left(\frac{n\pi}{T}x\right) \\ b_n &= \frac{1}{T}\int_{-T}^{T} f(x)\sin\left(\frac{n\pi}{T}x\right) \end{aligned} \right)$$

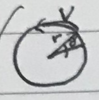
$$f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty}\left\{a_n\cos\left(\frac{n\pi}{T}x\right) + b_n\sin\left(\frac{n\pi}{T}x\right)\right\}$$

$$f(x) = \frac{1}{2T}\int_{-T}^{T} f(p)\,dp + \frac{1}{T}\sum_{n=1}^{\infty}\left\{\int_{-T}^{T} f(p)\cdot\cos\left(\frac{n\pi}{T}p\right)\cdot dp + \int_{-T}^{T} f(p)\cdot\sin\left(\frac{n\pi}{T}p\right)dp\right\}$$

$\times\cos\left(\frac{n\pi}{T}p\right)$ $\times\sin\left(\frac{n\pi}{T}p\right)$

$$f = \frac{1}{T} \Leftrightarrow \boxed{T = \frac{1}{f} = \frac{2\pi r}{v} = \frac{2\pi}{w}} \Longleftrightarrow \boxed{f = \frac{w}{2\pi}} \Rightarrow \boxed{w = 2\pi f = \frac{2\pi}{T}}$$

(전체주기 원주) → n등분 하자 $\boxed{\left[W_n = \frac{n\pi}{T}\right)}$



원주 $2\pi r$

시간: $\frac{2\pi r}{v} = \frac{2\pi}{w}$

$v = rw$

$w = \frac{v}{r}$

$$\Delta w = W_{n+1} - W_n = \frac{(n+1)\pi}{T} - \frac{n\pi}{T} = \frac{\pi}{T} \Longleftrightarrow \boxed{\frac{1}{T} = \frac{\Delta w}{\pi}}$$

$$f(x) = \frac{1}{2T}\int_{-T}^{T} f(p)\,dp + \frac{1}{\pi}\sum_{n=1}^{\infty}\left\{\cos(W_n p)\cdot\int_{-T}^{T} f(p)\cdot\cos(w_n p)\,dp + \sin(W_n p)\cdot\int_{-T}^{T} f(p)\cdot\sin(w_n p)\,dp\right\}\cdot\Delta w$$

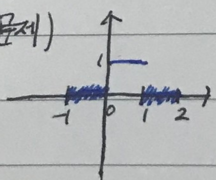
$$\lim_{T\to\infty} f(x) = 0 + \boxed{\frac{1}{\pi}}\int_0^{\infty}\left\{\cos(wp)\boxed{\int_{-\infty}^{\infty} f(p)\cdot\cos(wp)\,dp} + \sin(wp)\cdot\boxed{\int_{-\infty}^{\infty} f(p)\cdot\sin(wp)\cdot dp}\right\}\cdot dw$$

$\boxed{A_w = \frac{1}{\pi}\int_{-\infty}^{\infty} f(p)\cdot\cos(wp)\,dp}$ $\boxed{B_w = \frac{1}{\pi}\int_{-\infty}^{\infty} f(p)\cdot\sin(wp)\,dp}$

$\boxed{\int_0^{\infty}\{A_w\cdot\cos(wp) + B_n\sin(wp)\}\,dw}$

↳ QPSK, PSK

(문제)



(문제) $f(x) = e^{-2x} \quad (x > 0)$

$$A_w = \frac{1}{\pi}\int_{-\infty}^{\infty} f(x)\cdot\cos(wx)\,dx$$
$$= \frac{1}{\pi}\int_{0}^{\infty} e^{-2x}\cdot\cos(wx)\,dx$$
$$= \frac{1}{\pi}\times\frac{w}{2^2+w^2}$$

$$\int_0^{\infty} e^{-st}\cdot\cos(wt)\,dt = \frac{w}{s^2+w^2}$$

↳ $\boxed{\text{Laplace Integral (라플라스 적분)}}$

$$B_w = \frac{1}{\pi}\int_{-\infty}^{\infty} f(x)\cdot\sin(wx)\,dx$$
$$= \frac{1}{\pi}\int_{0}^{\infty} e^{-2x}\cdot\sin(wx)\,dx$$
$$= \frac{1}{\pi}\cdot\frac{2}{2^2+w^2}$$

$$\int_0^{\infty} e^{-st}\cdot\sin(wt)\,dt = \frac{s}{s^2+w^2}$$

$$\therefore f(x) = \int_0^{\infty}\frac{1}{\pi}\cdot\frac{w}{2^2+w^2}\cos(wx)+\frac{1}{\pi}\frac{2}{2^2+w^2}\sin(wx)\,dw$$

$$e^{-2x} = \frac{1}{\pi}\int_0^{\infty}\frac{w\cos(wx)}{2^2+w^2}\,dw$$

$$\boxed{\int_0^{\infty}\frac{w}{2^2+w^2}\cdot\cos(wx)\,dw = \frac{\pi}{2}\cdot e^{-2x}}$$

$$e^{-2x} = \frac{4}{\pi}\int_0^{\infty}\frac{1}{2^2+w^2}\cdot\sin(wx)\,dx$$

$$\boxed{\int_0^{\infty}\frac{1}{2^2+w^2}\sin(wx)\,dw = \frac{\pi}{4}e^{-2x}}$$

여기서 푸리에 트렌스폼을 하려면.

$$\boxed{\begin{array}{l}\text{Fourrier Transform}\\ F(x) = \int_{-\infty}^{\infty} f(x)\cdot e^{-iwx}\,dx\end{array}}$$

→ w 짜리 주파수를 뽑아낸다.

↳ 컴퓨터가 이것을 계산하면 DFT 혹은 FFT

$\left(\frac{x-t\ C}{1}\right)'$

〈Taylor Series〉 테일러 급수

→ 맥클로린 급수.

$\int_a^x f'(t)\,dt = f(x) - f(a)$

$\int_a^x (-1)(-f'(t))\,dt$

$\int f'(x)g(x) = f(x)g(x) - \int f(x)\cdot g(x)$

$\int_a^x (-1)\{-f'(t)\}\,dt = [t\cdot f'(t)]_a^x - \int_a^x t\cdot f''(t)\,dt$

$= [t\cdot f'(t)]_a^x - \{[\frac{1}{2}t^2\cdot f''(t)]_a^x$