

EE361

The Generalized Fourier Series

$$B\alpha = \begin{bmatrix} \langle f, \beta_0 \rangle \\ \langle f, \beta_1 \rangle \\ \vdots \\ \langle f, \beta_{n-1} \rangle \end{bmatrix}$$

weight ↑

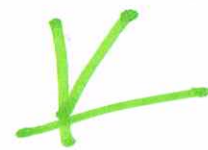
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$f(t) =$



$f_1(t) = t^0 = 1$

$f_2(t) = t^1$



Projectn(t) = $f_1 + f_2 + \dots + f_n$

$b_n = t^n$

$$\begin{bmatrix} \langle b_0, b_0 \rangle & \langle b_0, b_1 \rangle & \dots \\ \langle b_1, b_0 \rangle & \langle b_1, b_1 \rangle & \dots \\ \vdots & \vdots & \ddots \end{bmatrix}$$

$$\text{Proj}(t) = \frac{f_0(t)}{\text{Basis signal}} \cdot \frac{a_0}{\text{weight}} + f_1(t) \cdot a_1 + \dots + f_{n-1}(t) \cdot a_{n-1}$$

$$b_0 = t^0 = 1 \quad \langle b_0, b_0 \rangle = \int_0^1 1 \cdot 1 dt = 1$$

$$\langle b_0, b_1 \rangle = \int_0^1 1 \cdot t dt = \frac{t^2}{2} \Big|_0^1 = 0.5$$

$$\langle b_1, b_1 \rangle = \langle t^1, t^1 \rangle = \int_0^1 t \cdot t dt = \int_0^1 t^2 dt = \frac{t^3}{3} \Big|_0^1 = 0.333$$

$$\langle b_{n-1}, b_{n-1} \rangle$$

$$\begin{bmatrix} 1 & .5 & \dots \\ -.5 & .3 & \dots \\ \dots & \dots & \dots \end{bmatrix}$$

$$\langle f(t) = e^t \cdot b_0 \rangle = \int_0^1 e^t \cdot t^0 dt$$

$$C_n = e^{j2\pi n t} + C_0 = 1$$

~~$$\pi = 1 : N-1$$~~

$$f_p(t) = \sum_{n=0}^N \text{weights} \cdot DC + d_1 \left(\frac{e^{j2\pi t} + e^{-j2\pi t}}{2} \right) + d_2 \left(\frac{e^{j4\pi t} + e^{-j4\pi t}}{2} \right) + \dots + d_{M-1} \left(\frac{e^{j2\pi(N-1)t} + e^{-j2\pi(N-1)t}}{2} \right)$$

$$\left(\cos w = \frac{e^{jw} + e^{-jw}}{2} \right)$$

