Office Hours

CMPE 240

#3) $f: \mathbb{R}^n \to \mathbb{R}^m$ is linear

$$f(a+b) = f(a) + f(b)$$
$$f(\alpha a) = \alpha f(a)$$

} linear

Show that there exist $A \in \mathbb{R}^{m \times n}$

$$f(x) = Ax \quad \forall x \in \mathbb{R}^n$$

A_{ij}

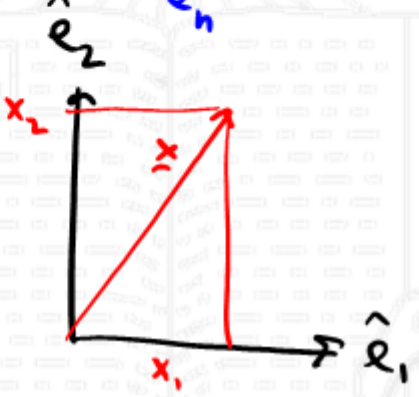
$f: \mathbb{R}^n \rightarrow \mathbb{R}^m \quad \longleftrightarrow \quad f(x) = Ax \quad x \in \mathbb{R}^n$

$A \in \mathbb{R}^{m \times n}$

$$\underline{x} \longleftrightarrow x_1 \begin{bmatrix} 1 \\ 0 \\ \vdots \\ 0 \end{bmatrix} + x_2 \begin{bmatrix} 0 \\ 1 \\ \vdots \\ 0 \end{bmatrix} + \cdots + x_n \begin{bmatrix} 0 \\ 0 \\ \vdots \\ 1 \end{bmatrix}$$

$\hat{e}_1 \qquad \hat{e}_2 \qquad \hat{e}_n$

$$\underline{x} = \sum_{i=1}^{n} x_i \hat{e}_i$$



$$f(\underline{x}) = f(x_1\hat{e}_1) + f(x_2\hat{e}_2) + \ldots + f(x_n\hat{e}_n)$$

$$= x_1 f(\hat{e}_1) + x_2 f(\hat{e}_2) + \ldots + x_n f(\hat{e}_n)$$

$$f(\underline{x}) = \underbrace{\begin{bmatrix} f(\hat{e}_1) & f(\hat{e}_2) & \cdots & f(\hat{e}_n) \end{bmatrix}}_{A} \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix}$$

$A \in \mathbb{R}^{m \times n}$

$\underline{x}$

$$f(x) = Ax = \tilde{A}x$$

$$(A - \tilde{A})\underset{m\times 1}{x} = \underset{m\times 1}{0}$$

$$\uparrow$$

$$\hat{e}_i$$

$$\underset{m\times n}{(A - \tilde{A})}\underset{m\times n}{\begin{bmatrix} | & & | \\ 0 & \cdots & 1 \\ | & & | \end{bmatrix}}\underset{n\times 1}{\quad}$$

#1) $P_{k+1} = A P_k + b$

A & b f(r, α, σ)

G

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A = [ . . . ; . . . ; . . . ];
b = [ . ; . ; . ];
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(r)

$P_1 = \begin{bmatrix} \cdot \\ \cdot \\ \cdot \end{bmatrix}$

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P2 = A*P1 + b;
P = [P1 P2'];
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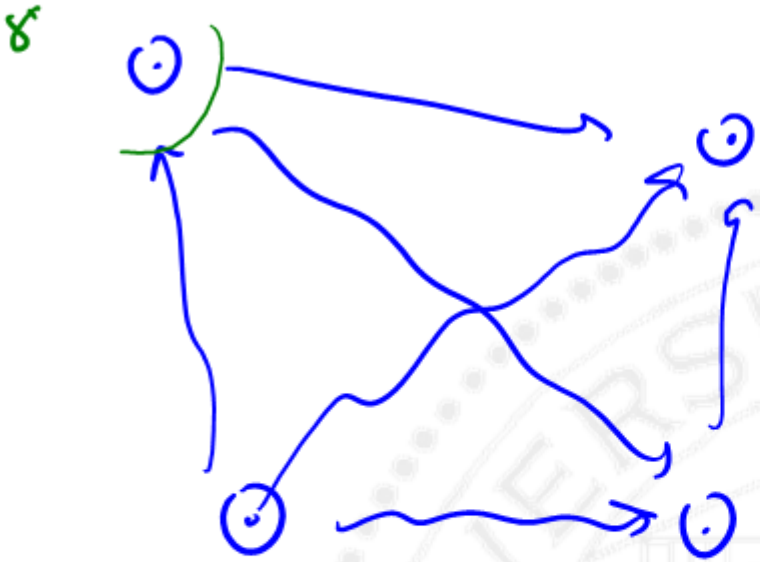


#5)

$$P(x) = a_{n-1}x^{n-1} + a_{n-2}x^{n-2} + \dots + a_1 x + a_0$$

$$a = \begin{bmatrix} a_0 \\ a_1 \\ \vdots \\ a_{n-1} \end{bmatrix}$$

$$Dp = \frac{dp}{dx}$$

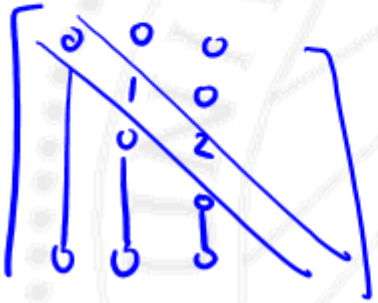
$$\frac{dp}{dx} = Da$$

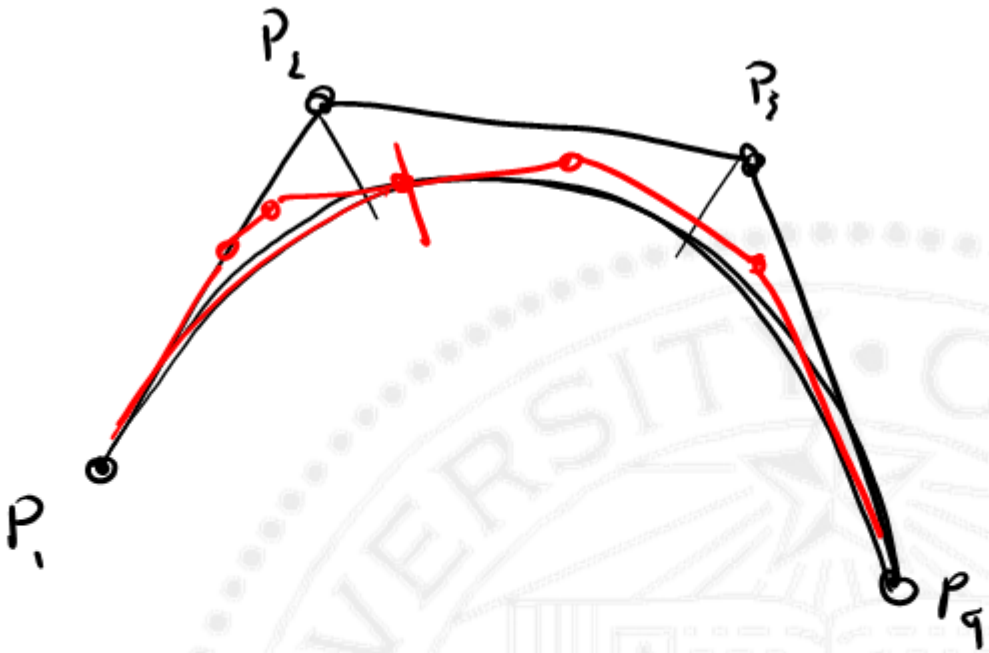
$$D = \begin{bmatrix} D\hat{e}_1 & D\hat{e}_2 & \cdots & D\hat{e}_{n-1} \end{bmatrix}$$

$D\hat{e}_1 \rightarrow \frac{dp}{dx}\left(\begin{bmatrix}1\\0\end{bmatrix}\right) \rightarrow p(x) = 0x^{n-1} + \ldots + 0x + a_0$ (1)

$$\left.\frac{dp(x)}{dx}\right|_{x=\hat{e}_1} = 0$$

$D\hat{e}_2 \rightarrow \frac{dp}{dx}\begin{pmatrix}0\\1\\0\end{pmatrix} \rightarrow p(x) = 0 + 0 + a_1 x + 0$ (1)




P1
P2
P3
P4