Bryan Ngo

Change o Basis

nductors

Complex Numbers

EECS 16B CSM

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Logistics

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Change o[.] Basis

Inductor

- fill out temperature check
- pertinent facts



- 1 Change of Basis
- 2 Inductors

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Change of Basis

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Complex Numbers

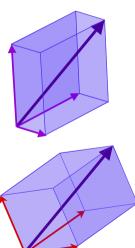
Change of Basis

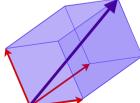
Motivation

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Change of Basis

- conversion from one linear coordinate system to another
- 3Blue1Brown video





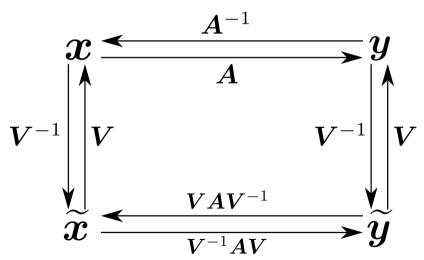
A Visualization

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Inductor



Diagonalization

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Change of Basis

Inductor

- want the eigenvectors to be the basis for a vector space
- makes math way easier

Diagonalization

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Change of Basis

- want the eigenvectors to be the basis for a vector space
- makes math wav easier

$$oldsymbol{V} = egin{bmatrix} oldsymbol{v}_1 & oldsymbol{v}_2 & \cdots & oldsymbol{v}_n \end{bmatrix}$$

$$\boldsymbol{A} \boldsymbol{V} = \begin{bmatrix} \lambda_1 \boldsymbol{v}_1 & \lambda_2 \boldsymbol{v}_2 & \cdots & \lambda_n \boldsymbol{v}_n \end{bmatrix}$$
 (2)

$$= \begin{bmatrix} \mathbf{v}_1 & \mathbf{v}_2 & \cdots & \mathbf{v}_n \end{bmatrix} \begin{bmatrix} \lambda_1 & 0 & \cdots & 0 \\ 0 & \lambda_2 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & \lambda_n \end{bmatrix}$$

$$= \mathbf{V} \mathbf{\Lambda} \implies \mathbf{\Lambda} = \mathbf{V}^{-1} \mathbf{A} \mathbf{V}$$

$$(3)$$

$$= V\Lambda \implies \Lambda = V^{-1}AV \tag{4}$$

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Basic Properties

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Change of Basis

Inductors

$$V_L \begin{cases} + \sqrt{I_L} \\ V_L \\ - \sqrt{I_L} \end{cases}$$

$$V_L = L \frac{d}{dt} I_L$$

- like a capacitor but for magnetic fields
- resists instantaneous change in current

Basic Properties

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Change of Basis

Inductors

$$V_L$$
 V_L
 V_L

$$V_L = L \frac{d}{dt} I_L$$

- like a capacitor but for magnetic fields
- resists instantaneous change in current
- what happens when $\omega = 0$? $\omega = \infty$?

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Inductor

Complex Numbers

Definition

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Change of Basis

Inductors

Complex Numbers

$$z = \underbrace{a + bj}_{ ext{rectangular}} = \underbrace{re^{j heta}}_{ ext{polar}}$$

- $a, b, r, \theta \in \mathbb{R}$
- $j^2 = -1$
- lacktriangle we use j in EE

(6)

Coordinate Transforms

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Change of Basis

Inductor

$$r^2 = a^2 + b^2 (7)$$

$$an(\theta) = \frac{b}{a} \tag{8}$$

$$a = \Re\{z\} = r\cos(\theta) \tag{9}$$

$$b = \Im\{z\} = r\sin(\theta) \tag{10}$$

Euler's Formula

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$$e^{j\theta} = \cos(\theta) + j\sin(\theta)$$
 (11)

- relevant 3Blue1Brown
- $e^{j\pi} + 1 = 0$ is a special case