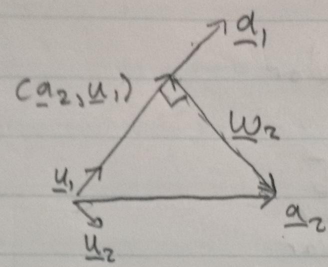


$$\underline{u}_i = \frac{\underline{w}_i}{\|\underline{w}_i\|} \qquad \underline{w}_i = \underline{a}_i - \sum_{j=1}^{i-1} (\underline{a}_i, \underline{u}_j)\,\underline{u}_j$$

Lecture 19 Nov. 18 2015

$\bar{a}$, $\|\bar{a}\|$, $\bar{a} \cdot \bar{b} = \|\bar{a}\| \|\bar{b}\| \cos\theta$

$$\theta = \arccos\left(\frac{\bar{a} \cdot \bar{b}}{\|\bar{a}\| \|\bar{b}\|}\right)$$

$\bar{a} \cdot \bar{b} \nearrow 0 \Rightarrow \bar{a} \perp \bar{b}$

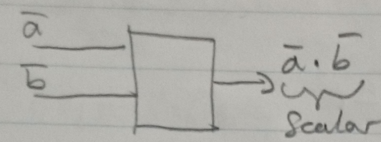
$\quad\searrow \max \Rightarrow \bar{a} = c\bar{b}$

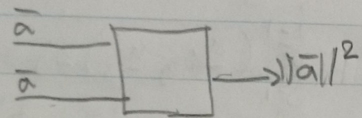
dot product shows how much the vectors look alike

$$\bar{a} \cdot \bar{a} = \|\bar{a}\|^2 \Rightarrow \|\bar{a}\| = \sqrt{\bar{a} \cdot \bar{a}}$$

<u>Statistics</u>		<u>Vectors</u>		<u>Waveforms (Signals)</u>
Correlation	=	dot product	=	inner product

dot product Operator





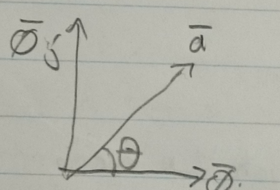
Orthonormal basis Vectors

$\{\bar{\phi}_i\}_1^N$; $\bar{\phi}_i \cdot \bar{\phi}_j = 0$, $i \neq j$

$\bar{\phi}_i \cdot \bar{\phi}_i = 1$, $\forall i$

$\{\bar{\phi}_i\}_1^N$ <u>spans</u> the N-dim space

↳ not unique



$$\bar{a} = \underbrace{\sum_{i=1}^{N} a_i \bar{\phi}_i}_{\text{decomposition}}$$

projection of $\bar{a}$ on the $\bar{\phi}_i$ axis

$a_i = \bar{a} \cdot \bar{\phi}_i$

$= \|\bar{a}\| \|\bar{\phi}_i\| \cos\theta$

Inner product

$\int s_1(t) s_2(t)\, dt$

$\int S_1(f) S_2(f)\, df$

Orthonormal basis functions: $\{\phi_i(t)\}_1^N \rightarrow \int \phi_i(t) \phi_j(t)\, dt = \delta_{ij} \begin{cases} 1, & i=j \\ 0, & i \neq j \end{cases}$