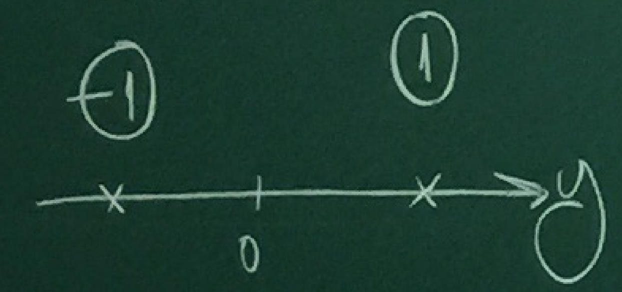
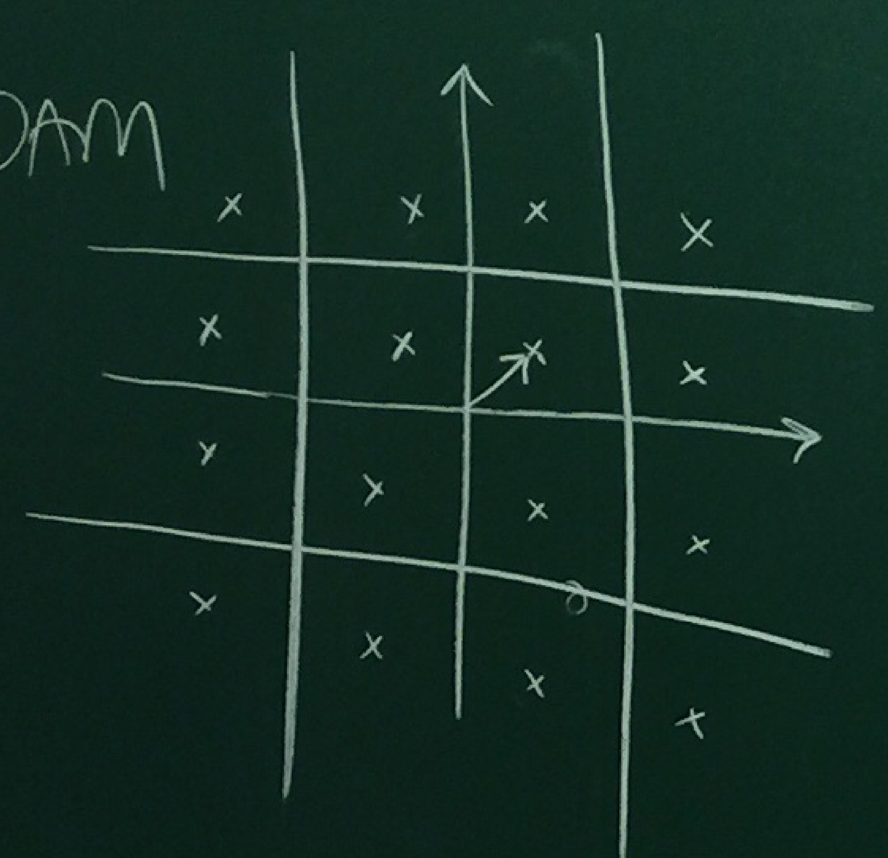
Nov 17/2016

Represent waveforms as Vectors

B-PAM

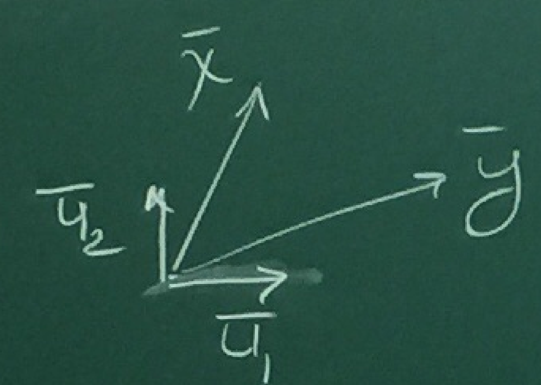


16QAM



$*\ x(t) \longrightarrow \|\bar{x}\| = \sqrt{E_x}$

$*\ x(t), y(t) \rightarrow \cos\theta_{xy} = \dfrac{(x(t), y(t))}{\sqrt{E_x}\sqrt{E_y}}$



$\bar{x} = \alpha_1\bar{u}_1 + \alpha_2\bar{u}_2$

orthonormal, basis vectors

$\{\bar{u}_i\}$: orthonormal basis

$$\bar{u}_i \cdot \bar{u}_j = \delta_{ij}, \forall i j$$

Gram-Schmidt Orthogonalization

From $\{\bar{x}_i\}_{i=1}^{N}$, obtain $\{\bar{u}_i\}_{i=1}^{K}$

1) $\bar{u}_1 = \dfrac{\bar{x}_1}{\|\bar{x}_1\|}$

2) $\bar{w}_2 = \bar{x}_2 - \overbrace{\bar{x}_2 \cdot \bar{u}_1}^{\text{scalar}}\, \bar{u}_1$

$\bar{u}_2 = \dfrac{\bar{w}_2}{\|\bar{w}_2\|}$

3) $\bar{w}_3 = \bar{x}_3 - \bar{x}_3 \cdot \bar{u}_1\, \bar{u}_1 - \bar{x}_3 \cdot \bar{u}_2\, \bar{u}_2$

$\bar{u}_3 = \bar{w}_3 / \|\bar{w}_3\|$

4) $\bar{w}_i = \bar{x}_i - \sum_{j=1}^{i-1} \bar{x}_i \cdot \bar{u}_j\, u_j \longrightarrow \bar{u}_i = \dfrac{\bar{w}_i}{\|\bar{w}_i\|}$