X_1, X_2

$$\boxed{Corr[X,Y] = \frac{Cov[X,Y]}{\sqrt{Var[X]\,Var[Y]}}}$$

$\mu_{A_1} = 0$

$\mu_{A_2} = 0$

$X_t \quad t=1, t=2$

$$\rightarrow X_t = A_1\cos(\omega t) + A_2\sin(\omega t) \quad t \in \mathbb{Z}$$

$$P(Y|W) = \mu_Y + a^T(W - \mu_W)$$

$$\rightarrow p(x_2|x_1)$$

$$\rightarrow P_2 X_1 = a X_1$$

$$\Gamma a = \gamma$$

covariance matrix of predictors

cov between Y, predictors

$$Var[X_1]a = Cov[X_2, X_1]^T$$

Γ_W $\quad W \quad Y \quad W$

$= \rho$

$$a = \frac{Cov[X_2, X_1]}{Var[X_1]} = \frac{Cov[X_2,X_1]}{\sqrt{Var[X_1]Var[X_1]}} = \frac{Cov[X_2,X_1]}{\sqrt{Var[X_2]Var[X_1]}}$$

$$a = \rho(x_1, x_2)$$

$Var[A_i] = 1$

$\mu_{A_i} = \mu_{A_n} = 0$

unit variance

$$X_t = A_1\cos(\omega t) + A_2\sin(\omega t)$$

$Var[aX] = a^2 Var[X]$

$E[aX] = aE[X]$

$$Var[X_{(1)}] = \cos^2(\omega)Var[A_1] + \sin^2(\omega)Var[A_2]$$
$$= \cos^2(\omega) + \sin^2(\omega) = 1$$

$$Cov[X_2, X_1] = E\left[(A_1\cos(\omega 2) + A_2\sin(\omega 2))(A_1\cos(\omega) + A_2\cos(\omega))\right]$$

$$= \cos(2\omega)\cos(\omega) + \sin(2\omega)\sin(\omega) = \boxed{\cos(\omega)}$$

$$\boxed{a = \cos(\omega)} \qquad \boxed{P_1 X_2 = aX_1 = \cos(\omega)X_1} \qquad Var[Y] - a^T\gamma$$

$$MSE[P_2X_1] = E\left[(X_2 - P_1X_2)^2\right] = Var[X_2] - \cos(\omega)Cov[X_2, X_1]$$

$$\boxed{= 1 - \cos^2(\omega)}$$