

Consider a System is represented in Standard State Space form as:-

$$\dot{X} = AX + BU \quad \text{--- (1)}$$

$$Y = CX + DU \quad \text{--- (2)}$$

Let us define a new set of state variables by the linear transformation

$$X = PZ \quad \text{--- (3)}$$

This means x_i is linear combination of z_i .

~~Where~~ {Where P is eigen vector matrix of A }

\Rightarrow Putting eq (3) in (1) we get:-

$$P\dot{Z} = APZ + BU$$

$$\Rightarrow \dot{Z} = P^{-1}APZ + P^{-1}BU$$

$$\Rightarrow \dot{Z} = \Lambda Z + P^{-1}BU \quad \left\{ \Lambda \text{ is diagonal matrix} \right\}$$

So findy Systr can be represented in diagonal form as:-

$$\begin{cases} \dot{Z} = \Lambda Z + B'U \\ Y = C'Z + DU \end{cases}$$

Where,

$$\Lambda = P^{-1}AP$$

$$B' = P^{-1}B$$

$$C' = CP$$