Alternate Methods of Observability

→ Equations to keep in mind

→ $y(t) = C e^{A(t)} x(0)$ state transition matrix ✓

→ like in the case of controllability matrix, if you apply transformation in this matrix, we get

$$\dot{z} = P^{-1}AP\,z = Dz$$

$$y = CPz$$

Now, the observability eq^n becomes

$$y(t) = CP\,e^{D(t)}\,z(0)$$

and so

$$y(t) = CP \begin{bmatrix} e^{\lambda_1 t} & \cdots & \cdots & 0 \\ 0 & e^{\lambda_2 t} & \cdots & 0 \\ 0 & 0 & e^{\lambda_3 t} \cdots & 0 \\ \cdots & \cdots & \cdots & e^{\lambda_n t} \end{bmatrix} z(0)$$

Hence now when no row in CP is completely zero, we will get a system that is completely observable.

Hence the conditions will be

that

→ no row in CP should be zero

→ eigen vectors should be distinct

Now as done in the case of observability we can do in the case of controllability for Jordan blocks.

$\dot{z} = S^{-1} A S z = J z$

$y = \boxed{SC} z$

→ condition

- No 2 JB should belong to same eig vector

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and so on!