→ What if P doesn't satisfy the conditions in TI Lemma or PTV lemma??

→ Stabilization may be possible by using a Switch Box in addition to PTV controllers.

→ Now $\Sigma(P+S)$ is a PTV system

Let

$$P = \begin{bmatrix} P_{11} & P_{12} \\ P_{21} & P_{22} \end{bmatrix} \qquad S = \begin{bmatrix} 0 & J_1 \\ J_2 & 0 \end{bmatrix}$$

Their N lifting systems.

$$\tilde{P} = \begin{bmatrix} \tilde{P}_{11} & \tilde{P}_{12} \\ \tilde{P}_{21} & \tilde{P}_{22} \end{bmatrix} \qquad \hat{S} = \begin{bmatrix} 0 & \hat{J}_1 \\ \hat{J}_2 & 0 \end{bmatrix}$$

To construct $\hat{J}_i$, decompose $s \in \{0,1,2\}^N$ of S into $s_i \in \{0,1\}^N$, $i = 1,2$ s.t. $s = s_1 + 2s_2$

Now $\hat{J}_i = \text{diag}(s_i)$, $i = 1,2$

eg:

$s = [1\ 1\ 2] \xrightarrow{\text{decompose}} s_1 = [1\ 1\ 0]$, $s_2 = [0\ 0\ 1]$

Now

$$\tilde{\Sigma} = \tilde{S}_e \tilde{P} \ ;$$

$\tilde{S}_e$ TI memoryless

$$\tilde{S}_e = \begin{bmatrix} I & 0 \\ 0 & \tilde{J}_1 \\ \hat{J}_2 & 0 \\ 0 & I \end{bmatrix} \in \mathbb{R}^{2(p_1+p_2)N \times (p_1+p_2)N}$$