Control of LPV

I will concentrate on the state feedback: quadratic stabilisation, robust stabilisation for polytopic LPV systems.

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- Literature: [CB], Appendix C.5 (Positive Real Lemma), Chapters Ch.3.3, pp. 96-107, Ch.3.4, pp. 107-109. Pay special attention to the following results: Theorem 3.3.1, Theorem 3.3.6, Theorem 3.4.1. and Theorem 3.4.2.
- Exercises:
  1. Compute L_2-gain for the transfer function $u \mapsto y$ system

$$\begin{aligned} \dot{x}(t) &= Ax(t) + Bu(t) \\ y(t) &= Cx(t). \end{aligned}$$

     with

$$A = \begin{bmatrix} -1 & 3 \\ 0 & -1 \end{bmatrix}, \; B = \begin{bmatrix} 0 \\ 1 \end{bmatrix}, \; C = \begin{bmatrix} 1 & 0 \end{bmatrix}$$

  2. Design a state-feedback for the following polytopic LPV system

$$\begin{aligned} \dot{x}(t) &= A(\lambda(t))x(t) + Bu(t) + E(\lambda(t))w(t) \\ z(t) &= C(\lambda(t))x(t) + Du(t) + F(\lambda(t))w(t) \\ x(0) &= x_0, \end{aligned}$$

     where $A_1 = \begin{bmatrix} -1 & 3 \\ 0 & 1 \end{bmatrix}$, $A_2 = \begin{bmatrix} 5 & 7 \\ 0 & -1 \end{bmatrix}$ $A_3 = \begin{bmatrix} 4 & 3 \\ 0 & -2 \end{bmatrix}$ $B = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$, $E = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$, $C = \begin{bmatrix} 2 & 0 \\ 0 & 3 \end{bmatrix}$, $D = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$, $F = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$ that stabilizes
     - quadratically
     - robustly for $\dot{\lambda} \in \text{vert}((0.1, 0, 0), (0, 0.1, 0), (0, 0, 0.1))$.