Assignment for colloquium 5

Given the discrete time bilinear system

$$x_{k+1} = \begin{bmatrix} 1 & 0.01 \\ 0.01 & 1 \end{bmatrix} x_k + \left(\begin{bmatrix} 0.001 & 0 \\ 0 & -0.004 \end{bmatrix} x_k + \begin{bmatrix} 0.09 \\ 0.09 \end{bmatrix} \right) u_k$$

and the Lyapunov function

$$V(x_k) = x_k^T \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} x_k$$

Design a controller to stabilize the system in as large a region as possible (when using the specified Lyapunov function).

Additional tasks (not covered by solution manual):

- Improve performance by specifying a certain rate of decay for the Lyapunov function
- Try to further enlarge the stable area by allowing for a different Lyapunov function (will involve an iterative solution, iterating between optimizing the Lyapunov function and optimizing the controller parameters).