

Consider the following linear discrete time system with initial state [2, 1].

$$\mathbf{x}(k + 1) = \begin{bmatrix} 0.9974 & 0.0539 \\ -0.1078 & 1.1591 \end{bmatrix} \mathbf{x}(k) + \begin{bmatrix} 0.0013 \\ 0.0539 \end{bmatrix} u(k)$$

which is to be controlled to minimize the follow performance measure,

$$J = \frac{1}{2} \sum_{k=0}^{N-1} [0.25x_1^2(k) + 0.05x_2^2(k) + 0.05u^2(k)].$$

Determine the optimal control law.

Use the Q, R given in the above, and let H=identity matrix.

Plot 3 sets of results for N=50, 100, 200, respectively.

Each set of the results should include the feedback gain, the optimal control, and the states. Also determine the optimal cost for each of the three N values.

Also attach a copy of your simulation code.