**EE49001: Control and Electronic System Design**

Assignment-10: Effect of Disturbance

Submitted By:

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# System Without Disturbance

Considering a system:

We have:

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## Open Loop Stability:

Eigen values of the matrix . Since, one eigen value of matrix . Therefore, the system is open loop unstable.

## System Controllability:

For system controllability, the rank of the controllability matrix must be equal to . Controllability Matrix, is defined as:

Where: denotes the size of the state-space. Here,

Controllability Matrix (calculated using MATLAB):

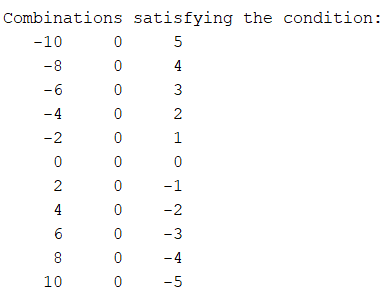
Rank of the matrix . Therefore, system is uncontrollable.

## Determination of for for different initialization

For determining the values of using values of and can be done by running the following MATLAB script. We take different initializations for and based on the allowable range. The script runs for various initializations of and different values at different time steps and display the results which satisfy the constraint:

**MATLAB**

|  |
| --- |
| % Define time horizon  T = 10;  % Define state and input constraints  x\_min = -10;  x\_max = 10;  u\_min = -5;  u\_max = 5;  satisfying\_combinations = [];  % Iterate through all combinations of x0 and u  for x0\_1 = x\_min:x\_max  for x0\_2 = x\_min:x\_max  for u = u\_min:u\_max  % Initialize x  x = zeros(2, T+1);  x(:,1) = [x0\_1; x0\_2];    % Iterate to compute x(t) for t = 1 to T  for t = 1:T  x(:,t+1) = A\*x(:,t) + B\*u;  end    % Check if condition is satisfied for all time steps  if all(x(:) >= -10) && all(x(:) <= 10)  satisfying\_combinations = [satisfying\_combinations; [x0\_1, x0\_2, u]];  end  end  end  end  % Display satisfying combinations  disp('Combinations satisfying the condition:');  disp(satisfying\_combinations); |



**Fig.** Output format