LINEAR SYSTEMS CONTROL

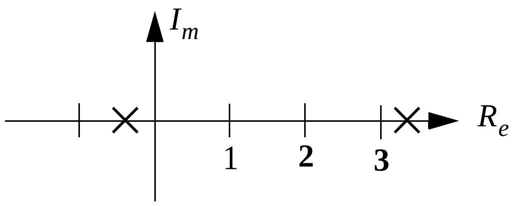
Solutions to Problems

Problem 3.8

1. The eigenvalues may be determined from:

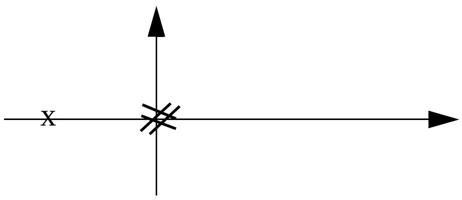
$$\det(\lambda\mathbf{I}-\mathbf{A}) = 0 \Rightarrow \begin{vmatrix} \lambda-1 & 1 \\ 3 & \lambda-2 \end{vmatrix} = (\lambda-1)(\lambda-2)-3$$

$$= \lambda^2 - 3\lambda - 1 = 0 \quad \text{for} \quad \lambda = \begin{cases} -0.303 \\ 3.30 \end{cases}$$



One eigenvalue in the right half plane and thus the system is unstable.

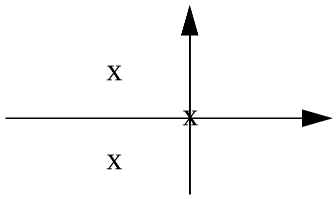
2. From Matlab one finds that: $\lambda = \begin{cases} 0 \\ 0 \\ -3 \end{cases}$.



There is a double eigenvalue on the imagining axis. The system is unstable.

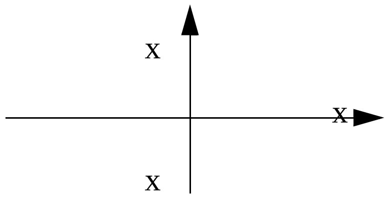
3. Again from Matlab one finds that $\lambda = \begin{cases} -3 \pm j \\ 0 \end{cases}$.

Problem 3.8 (continued)



One eigenvalue on the imagining axis and two in the left half plane. The system is Lyapunov stable.

4. The eigenvalues in this case are: $\lambda = \begin{cases} -1 \pm j2 \\ 2 \end{cases}$.



One eigenvalue is in the right half plane and two in the left half plane. The system is unstable.

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