# EECS 16B
# Designing Information Devices and Systems II

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Department of Electrical Engineering and Computer Science

# Announcements

- HW 9 due date moved to Saturday 3/30
- MT 2 covers lecture material through today
- student support meetings
  - 15 minutes 1-on-1 with course staff, any topic
  - sign up after spring break

# Today

- review
- spectral theorem
- minimum energy control

# Stability

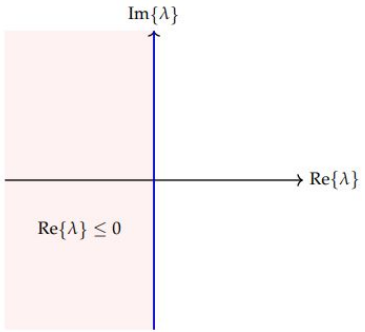
True or False:  Given a system that is internally (“state space”) stable, it must be BIBO stable as well.

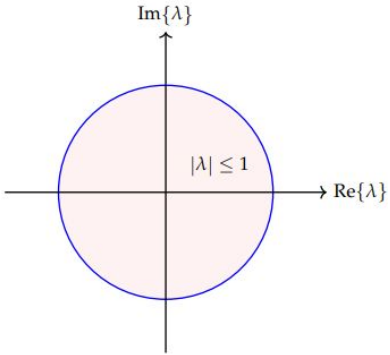
1. True
2. False

# Stability

True or False:  Given a system that is internally (“state space”) stable, it must be BIBO stable as well.

1. True
2. False



# Stability

True or False:  Given a system that is internally (“state space”) unstable, it must be BIBO unstable as well.

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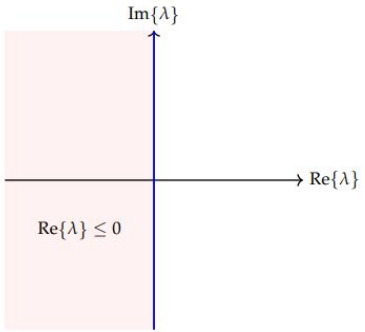
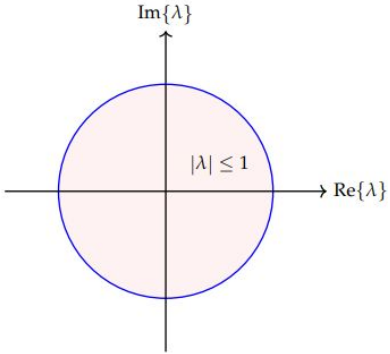


# Stability

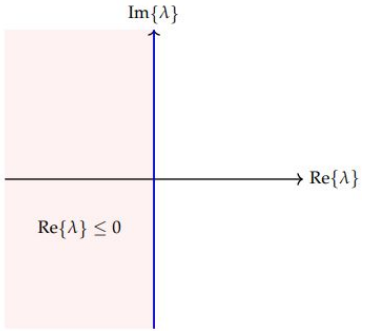
True or False:  Given a system that is internally (“state space”) marginally stable, it must be BIBO marginally stable as well.

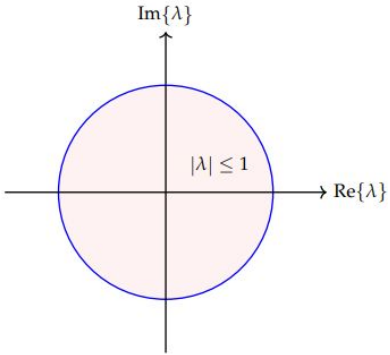
1. True
2. False

# Stability

True or False:  Given a system that is internally (“state space”) marginally stable, it must be BIBO marginally stable as well.

1. True
2. False



$$x_{i+1} = \begin{bmatrix} -2 & -1 \\ 0 & -3 \end{bmatrix} x_i + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u_i$$

Is this system stable?

1. yes
2. no

$$x_{i+1} = \begin{bmatrix} -2 & -1 \\ 0 & -3 \end{bmatrix} x_i + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u_i$$

Is this system controllable?

1. yes
2. no

# Orthogonal Vectors and Matrices

Suppose the columns of matrix Q are orthonormal. Q could be:

1. a tall matrix
2. a square matrix
3. a wide matrix
4. either tall or square, but not wide
5. either wide or square, but not tall

# Orthogonal Vectors and Matrices

Suppose the columns of matrix Q are orthonormal.

$$Q^T Q = ?$$

# Orthogonal Vectors and Matrices

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# Orthogonal Vectors and Matrices

Suppose the columns of matrix Q are orthonormal.

$$QQ^T = ?$$

# Orthogonal Vectors and Matrices

Suppose the columns of matrix Q are orthonormal.

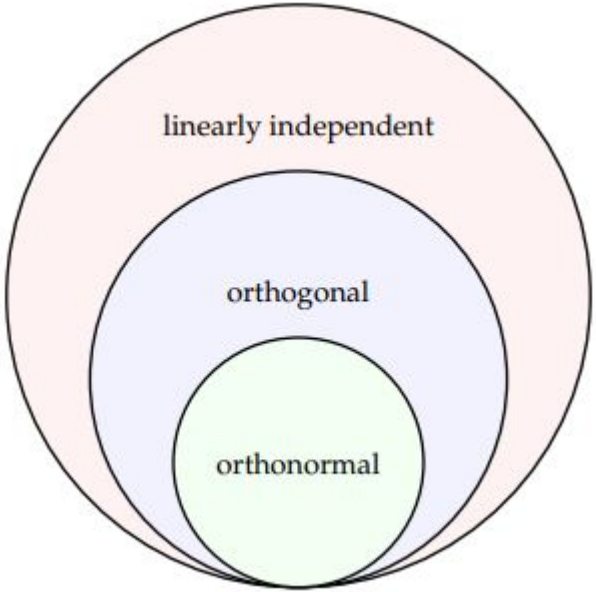
$$QQ^T = P$$

# Orthogonal Vectors and Matrices

Matrix Q is “orthogonal.” The following must be true:

1. Q is square
2. the columns of Q are orthogonal
3. the columns of Q have norm = 1
4. the rows of Q are orthonormal
5. all of the above

# Gram-Schmidt



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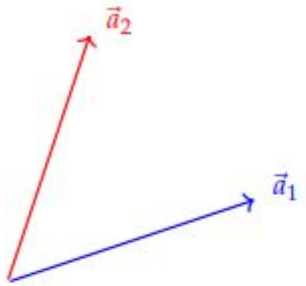

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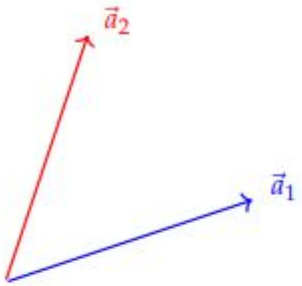


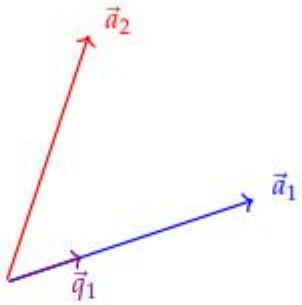

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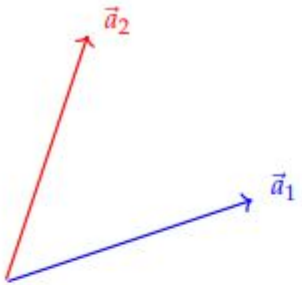


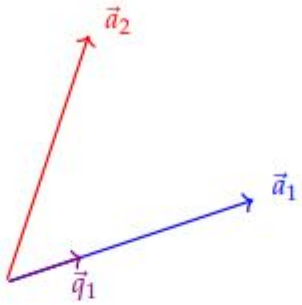


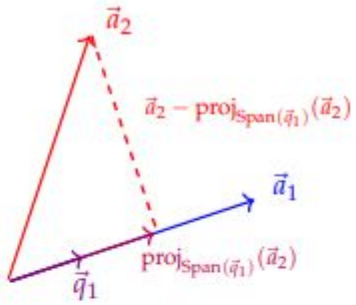

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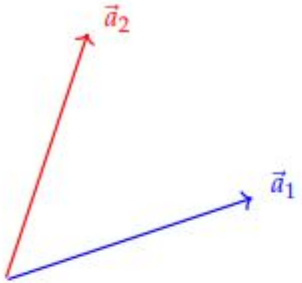


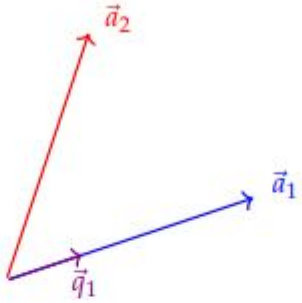


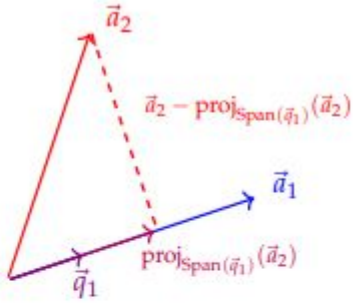


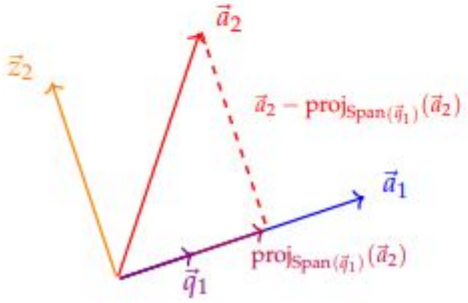

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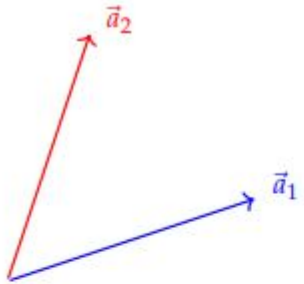


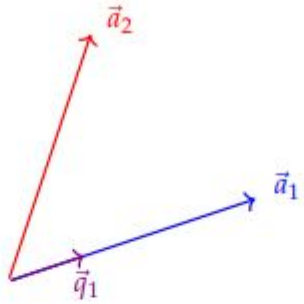


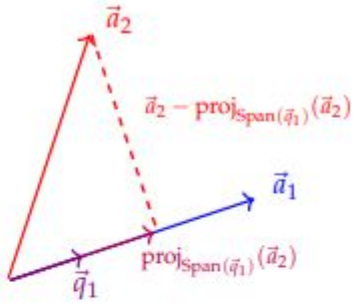


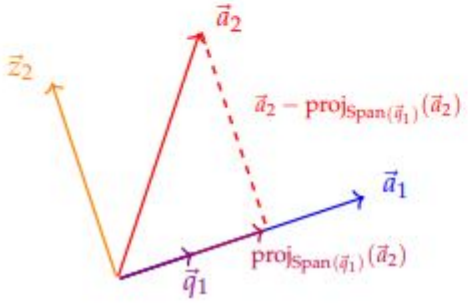


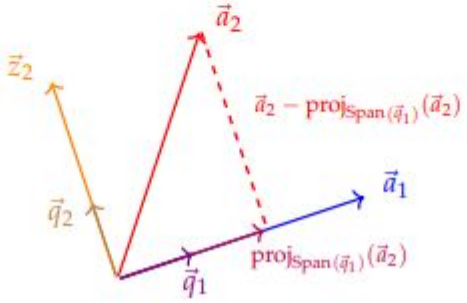

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