ENME489C/ENME808M HW 1

Prof. Axel Krieger
Fall 2017
Due Date: Tuesday 1 PM

August 30, 2017

Exercise 1:

$$\mathbf{a} = \begin{pmatrix} 3 \\ -1 \\ 1 \end{pmatrix} \qquad \mathbf{b} = \begin{pmatrix} 1 \\ 2 \\ 4 \end{pmatrix}$$

a) $\|\mathbf{a}\| =?$
$\|\mathbf{b}\| =?$

b) $\mathbf{c} = \mathbf{a} \times \mathbf{b}$

c) angle α between $\mathbf{a}$ and $\mathbf{b}$

Exercise 2:

a.

$$A = \begin{bmatrix} a & b & -a \end{bmatrix} \qquad rank(A) =?$$

where, a and b are vectors from Exercise 1.

b.

$$B = \begin{bmatrix} 0 & 1 \\ 1 & 1 \\ 2 & 3 \end{bmatrix} \qquad rank(B) =?$$

Exercise 3:

Spong Problem number 2-4

Exercise 4:

Spong Problem number 2-5 (a)

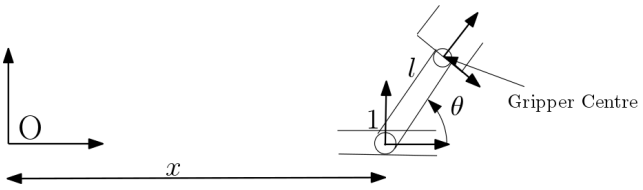

Figure 1: Exercise 5

Exercise 5:

Refer to figure 1 for this problem

a) What is the position of the gripper in the gripper frame?

b) What is the position of the gripper in the reference frame 1?

c) What is the position of the gripper in the reference frame O?

Exercise 6:

[**MUST for GRAD students and optional for undergrad students**].

Using the same figure as for Exercise 5. The gripper holds a ball at position $P^G_{ball} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$

a) What is the position of the ball with reference to frame 1. $P^1_{ball} = ?$

b) What is the position of the gripper in the reference frame O. $P^O_{ball} = ?$