Cairo University
Faculty of Engineering
Department of Biomedical Engineering and Systems
SBE 403 B - Bioelectronic Systems (Biomedical Robotics) - Spring 2020
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- This is an **individual** project. Each student should submit his (or her) own work and cite any used resources or tools.
- Most of the problems are based on the following textbooks:

[Corke 2011] Peter Corke, Robotics, Vision and Control - Fundamental Algorithms in MATLAB®. Springer Tracts in Advanced Robotics 73, Springer 2011, ISBN 978-3-642-20143-1, pp. 1-495 (2011) http://www.petercorke.com/RVC/

[Niku 2010] Saeed Niku, *Introduction to Robotics: Analysis, Control, Applications*, Wiley (2010).

[Craig 2005] John J. Craig, *Introduction to Robotics: Mechanics and Control*, Pearson Prentice Hall (2005)

[Spong 2004] Mark W. Spong, Seth Hutchinson, and M. Vidyasagar, *Robot Dynamics and Control*, Wiley (2004).
https://home.deib.polimi.it/gini/robot/docs/spong.pdf

[Vince 2011] John Vince, *Quaternions for Computer Graphics*, Springer (2011).

- All submissions should be made electronically to the email of the teaching assistant by the stated deadline.
- You are not required to turn in **example** or **practice** problems. These are just to help you understand, practice, and prepare for the final exam

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Project 01 - Representing Position and Orientation

Deadline: April 4th, 2020 @ 11:59 PM

A. From **[Corke 2011]**, solve the following exercises:

Exercise 4 page 41
Exercise 6 page 41

B. In **[Niku 2010]**, review (but don't turn in) the following examples: Examples 2.3-2.22 in pages 40-72.

C. From **[Niku 2010]**, solve the following problems:

Problem 2.5 page 104 (Also, plot the frame before and after transformation with `trplot`)
Problem 2.6 page 104 (Also, plot the frame with `trplot`)
Problem 2.9 page 104
Problem 2.11 page 104 (Also, plot the point before and after transformation)
Problem 2.14 page 105 (Also, plot the frame and point after each step with `trplot`)

Problem 2.17 page 105 (Also, plot the frame after each step with `trplot`)
Problem 2.20 page 105
Problem 2.24 page 106
Problem 2.27 page 106 (Also, plot the frame after each step with `trplot`)

D. In **[Craig 2005]**, review (but don't turn in) the following examples: Example 2.1-2.9 in pages 26-50.

E. From **[Craig 2005]**, solve the following exercises:
Exercise 2.4 page 54 (Also, plot the frame after each step with `trplot`)
Exercise 2.5 page 54
Exercise 2.9 page 55 (Use MATLAB or Python)
Exercise 2.13 page 55 (Draw the frame diagram (or pose graph) with `trplot`)
Exercise 2.16 page 56
Exercise 2.20 page 58
Exercise 2.21 page 58
Exercise 2.22 page 58
Exercises 2.32-2.34 page 59 (Draw the frame diagram (or pose graph) with `trplot`)
MATLAB Exercise 2B page 61

F. In **[Spong 2004]**, review (but don't turn in) the following examples: Examples 2.1-2.8 in pages 38-58.

G. In **[Vince 2011]**, review (but don't turn in) the examples in **5.20 Worked Examples** (pages 70-71) and **7.13 Worked Examples** (pages 125-129).

H. From **[Niku 2010]**, resolve the following problems using quaternions and visualize your steps using the Robotics Toolbox of **[Corke 2011]**:

Problem 2.11 page 104
Problem 2.14 page 105