MCEN90028 Robotics Systems
Assignment 2

Due date: 17 April, 2020, 5pm

1 Description of Task

This assignment will focus on constructing the Jacobian matrix for your robot.

In this assignment, you are expected to:

- State the purpose of the exercise. (1 sentence)
- Derive the Jacobian matrix for your robot that relates the translational velocity of the wrist point W and the angular velocity of the end-effector frame to the joint velocities.
  - Define Frame W, which is aligned and moving with the end-effector frame E, with its origin located at the intersection of rotation axes z_4 and z_5 (and z_6 if your design has it). This assumes that the rotational axes of your wrist intersect at one point. (1 mark)
  - Symbolically obtain the components of the Jacobian: z_i and $(r_W - r_i)$. (2 marks)
  - Put together the Jacobian. If you use any shorthand notation, such as S1, C1, S23, etc, please define them. (1 mark)
- Justify that your Jacobian is correct. (2 marks)
  - Carry out some basic validation exercise to numerically test your Jacobian at known poses, and/or compare your Jacobian to another technique such as using the partial derivative for the J_v component.
  - Remember that the point of this exercise is to argument and convince yourself and the marker that your Jacobian is correct!! Do what you need to communicate that to the marker. The more obvious you make your point, the clearer your argument is, the easier it is to mark your assignment and the likelihood of securing a higher mark is better. In the real world, your 'boss' will not know the 'correct' answer and it is up to you to verify that your code is correct before anything disasterous happens with the robot.

- You are expected to construct a Matlab function: $J = calculate\_Jacobian(q)$, which you will upload as part of the Assignment. The function will be specific to your designed robot. Define the various DH parameters and specify their values at the start of the function, for clarity.

2 Submission

You need to submit **ONE REPORT AND ONE SET OF MATLAB CODE PER ASSIGNMENT GROUP**.

The report should be in an **appropriate engineering report format** and submitted as a PDF. The report should be **no more than 8 pages** (everything included) with **12pt font size**.

The title of your report should be "Assignment2_Report_AG[#]" and the title of the main MATLAB file should be "Assignment2_Matlab_AG[#]" (put your AG group number in "[#]", eg. AG07).

Compress your report and all your relevant MATLAB files as a .zip file with folder name **"Assignment2_AG[#]"** (eg. Assignment2_AG07) and submit to LMS.

Note: only the last submission will be assessed.

Submission checklist:

- ☐ Report is no more than 8 pages
- ☐ Report has 12pt font size
- ☐ Report saved as PDF
- ☐ Titles of files are in the right format
- ☐ Compressed as a .zip file

3 Academic Integrity

We take academic integrity seriously. Please note that while the two assignment groups within one project group may discuss and share the robot design details, they should work on their assignments separately.

Details about academic integrity can be found on MCEN90028 Canvas page (under Subject Overview) or at `http://academicintegrity.unimelb.edu.au/`. Please

check with the tutors or the lecturer if you are in doubt. Ignorance is not a valid reason for academic misconducts.