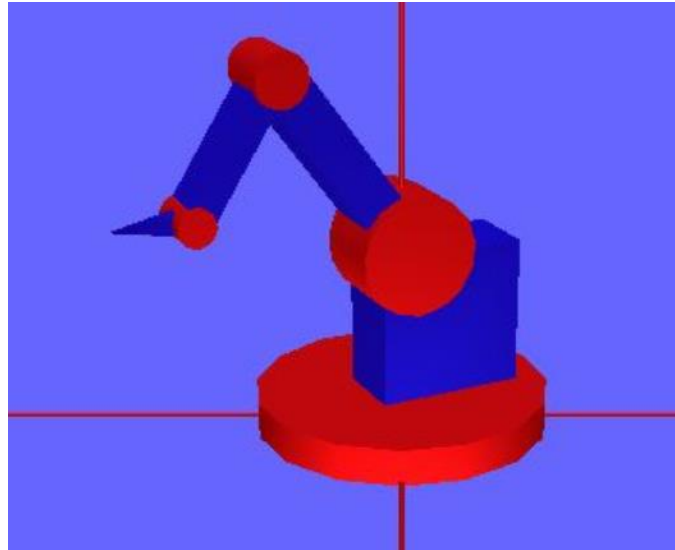


F20RO/F21RO INTELLIGENT ROBOTICS

COURSEWORK 1b ROBOT CONTROL PROGRAM

SUBMISSION DEADLINE 27.10.2021



Using a platform and development environment of your choice, edit the `robot.java` program provided to control the TCP of the robot as detailed below –

- (a) Develop an algorithm to determine the necessary joint angles to achieve the TCP position and orientation entered by the user. Code up your algorithm in Java and insert it into the Java program provided.
[70% of the marks will be awarded for this part]
- (b) This manipulator contains degeneracies. Develop a scheme for handling degenerate points so that only one joint angle solution exists for any TCP position and orientation (E.g. keeping the shoulder tilted up at all times would be a very simple scheme). You should describe your scheme in writing. **Optionally**, you could code up your scheme and insert it into the Java program but no additional marks will be awarded for this.
[30% of the marks will be awarded for this part]

Submission

Please submit the code which you have written and inserted into the program (NOT the whole program!) as part of a brief report (no more than 4 sides of 12 point A4) describing your algorithms (for the TCP control and for degeneracy handling). Additionally, you should video your program demonstrating TCP control by moving to at least TWO (x, y, z) positions with at least TWO orientations of the TCP, including one re-orientation of the TCP in which the (x, y, z) position remains unchanged. Your video should be a maximum of 2 minutes in length.

You should submit your report and video on Canvas by **27th October 2021**.

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Your report should be submitted as a single pdf file. Your video should be submitted as an mp4 file, which captures your screen and video commentary using an app such as OBS Studio.

OBS Studio can be downloaded from here <https://obsproject.com/welcome> and a guide on how to create an mp4 video with OBS is here <https://www.youtube.com/watch?v=LWwqbHU8L0>

You can download the `robot.java` program from –

<http://www.macs.hw.ac.uk/~nkt/robot.java>

to compile and execute it from the command line on the [MACS Linux Virtual Machine](#) or a computer in the MACS Linux Lab in Edinburgh (EM2.50) or you can fork it from the *gitlab-student* project here –

<https://gitlab-student.macs.hw.ac.uk/f21ro2021-2022/intelligent-robotics-cw-1b>

to work with it in the Eclipse IDE.

See also the accompanying additional notes on compiling and executing the program.

Marks will be awarded for demonstrating TCP control of the robot and adopting a sensible scheme for degeneracy handling

This coursework contributes 35% to your final mark for the course.

Feedback

Feedback will be provided to students approximately three working weeks after the submission of coursework.

Late submission of coursework

Coursework deadlines are fixed and individual coursework extensions will not be granted. Penalties for the late submission of coursework follow the university's policy on late submissions:

- The mark for coursework submitted late, but within 5 working days of the coursework deadline, will be reduced by 30%.
- Coursework submitted more than 5 working days after the deadline will not be marked.
- In a case where a student submits coursework up to 5 working days late, and the student has valid mitigating circumstances, the Mitigating Circumstances policy will apply. Students should submit a Mitigating Circumstances application for consideration by the Mitigating Circumstances Committee.

The MACS School policy on coursework submission is that **the deadline for coursework submissions**, whether hard-copy or online, is **3:30pm (Edinburgh local time)** for the Edinburgh Campus and **5:00pm (Dubai local time)** for UG and **11:59pm for PG** for the Dubai Campus. The University Policy on the Submission of Coursework can be found here: <https://www.hw.ac.uk/services/docs/learning-teaching/policies/submissionofcoursework-policy.pdf>

Mitigating Circumstances (MC)

There are circumstances which, through no fault of your own, may have affected your performance in an assessment (exams or other assessment), meaning that the assessment has not accurately measured your ability. These circumstances are described as **mitigating circumstances**. You can submit an application to have mitigating circumstances taken into account. Full details on the university's policies on mitigating circumstances and how to submit an application can be found here:

<https://www.hw.ac.uk/students/studies/examinations/mitigating-circumstances.htm>

Plagiarism

"Plagiarism is the act of taking the ideas, writings or inventions of another person and using these as if they were your own, whether intentionally or not. Plagiarism occurs where there is no acknowledgement that the writings, or ideas, belong to or have come from another source." (Heriot-Watt University Plagiarism Policy). This coursework must be completed independently:

- Coursework reports must be written in a student's own words and any submitted code in the coursework must be your own code. Short sections of text or code taken from approved sources like the lecture examples may be included in the coursework provided these sources are **properly referenced**.
- Failure to reference work that has been obtained from other sources or to copy the words and/or code of another student is plagiarism and, if detected, this will be reported to the School's Discipline Committee. If a student is found guilty of plagiarism, the penalty could involve voiding the course.
- Students must **never** give hard or soft copies of their coursework reports or code to another student. Students must **always refuse** any request from another student for a copy of their report and/or code.

- Sharing a coursework report and/or code with another student is **collusion**, and if detected, this will be reported to the School's Discipline Committee. If found guilty of collusion, the penalty could involve voiding the course.

Plagiarism will be treated extremely seriously as an act of academic misconduct which will result in appropriate student discipline. All students should familiarise themselves with the university policies around plagiarism which can be found here: <https://www.hw.ac.uk/students/studies/examinations/plagiarism.htm>