Computer Graphics, Lab Assignment 10

Handed out: May 23, 2021

Due: 23:59, May 24, 2021 (NO SCORE for late submissions!)

- *Only files submitted by **git push to this course project at https://hconnect.hanyang.ac.kr** (<Year>_<Course no.>_<Class code>/<Year>_<Course no.>_<Student ID>.git) will be scored.*

- *Place your files under the directory structure **<Assignment name>/<Problem no.>/<your files>** just like the following example.*

```
+ 2021_ITE0000_2019000001
  + LabAssignment2/
    + 1/
      - 1.py
    + 2/
      - 2.py
    + 3/
      - 3.py
```

- *The submission time is determined not when the commit is made **but when the git push is made**.*

- *Your files must be committed to the **master branch**. Otherwise, it will not be scored.*

1. Write down a Python program to render a 2-joint arm and visualize the position and velocity of the arm using forward kinematics.

    A. Set the window title to your student ID and the window size to (640, 640)

    B. Start from LabAssigment10-code-skeleton.py.

        i. When program begin, you can see two white boxes aligned on x axis. Each box represents each link of this arm chain.
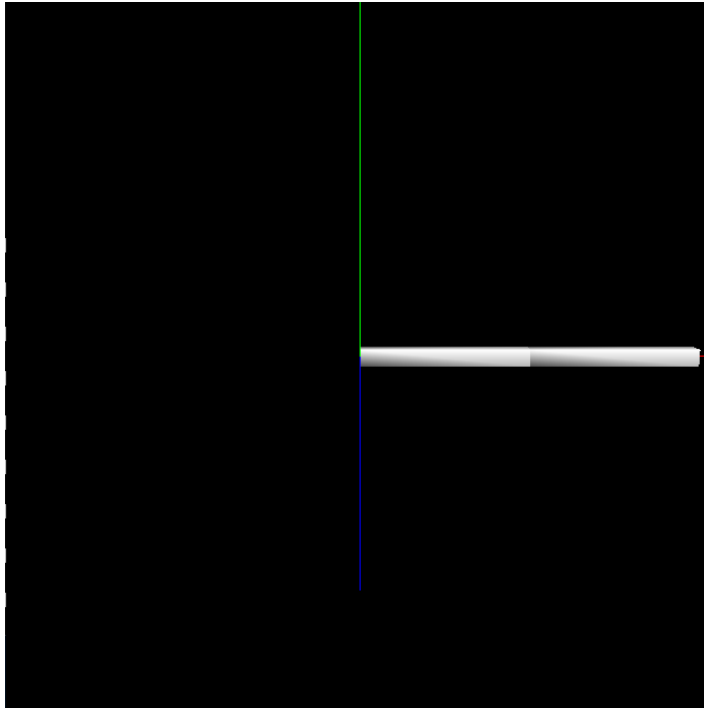
C. You should rotate these two joints, by updating the rotation matrices R1 and R2.

    i. R1 and R2 should be calculated from XYZ Euler Angles.

    ii. The joint 1 should be t rad rotated by Y axis when t seconds have elapsed since the program was executed. Its rotation is represented by the rotation matrix R1.

    iii. The joint 2 should be t rad rotated by X axis and t rad rotated by Z axis when t seconds have elapsed since the program was executed. Its rotation is represented by the rotation matrix R2.

D. You should visualize the position of the end point of the arm, with some lines or little box.

    i. The end point is at the center of the outermost face of the second link.

E. You should draw a line for showing the velocity of end point.

    i. The velocity can be calculated using the difference between the current and previous positions of the end.

    ii. The length of the line (magnitude of velocity) should be calculated per second.

    iii. The velocity vector start at the current end point and its direction is to next frame.

F. Expected result: Uploaded LabAssignment10-1.mp4

    i. To compare your result with video, rotate camera by press key '3', 4 times.

G. Files to submit: A Python source file (Name the file whatever you want (in English). (Extension should be .py)