

Lab#7 Kinematics library for a robotic arm in C

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Objectives:

- Write a kinematics library in C to control a robotic arm.

Hardware: PC

To hand in on Teams:

Answers to all questions on Teams assignment.
Kinematics library uploaded to GitHub.

File system structure:

See the following hierarchy. You must populate the files in **orange**.

- multithread_mover4_v6\pdcurses_test\mover4_v6
 - can.c
 - task_controller.c
 - log
 - state
 - ncurses_init.c
 - adc.c
 - **sol_mover4**
 - build
 - mover4.c
 - taskKeybd.c
 - taskAuto.c
 - taskDisplay.c
 - **kinematic.c**
- **header**
 - can.h
 - adc.h
 - **kinematic.h**
 - public.h
 - task_controller.h
 - ncurses_init.h
- **demo**
 - exec
- **excel_sim**
 - animation_v2
 - export

GitHub repo: clone your repo.

Lab Work

Measure all the links of mover 4 robot arm (in inches)

baseHeight	humerusLength	armLength	gripLength
8.5 inches	7.25 inches	8.75 inches	6 inches

Using the following structure:

```
typedef struct{
    double data[4];    // stores all 4 values
}kin_f;
```

kin_f structure is already defined inside task_controller.h file.

You must write the following APIs inside two files named kinematic.c and kinematic.h

to_radians(): converts angles from degrees to radians

double to_radians(double degrees)

to_degrees(): converts angles from radians to degrees .

double to_degrees(double radians)

to_angle(): converts from x-y-z-grip_angle to angles (inverse kinematics). The returned angles are: base_angle, shld_angle', elb_angle' and wri_angle'

kin_t to_angle(double x, double y, double z, double grip_angle)

to_cart(): converts from angles to x-y-z (forward kinematics). The angles parameters are: base_angle, shld_angle', elb_angle' and wri_angle'

kin_t to_cart(double base_angle, double shld_angle , double elb_angle, double wri_angle)

Test your new APIs

The best way to test your newly created APIs is to call them from taskAuto in simulation mode with specific values.

Did you get the similar results as the table below when you called the inverse kinematics functions to_angle() and to_cart()?

- The results that were obtained while testing the to_angle() and to_cart() functions yielded results very close to those shown in the table below.

x, y, z, (inches)	grip angle to horizon (°)	shld_angle' (°)	elb_angle' (°)	wri_angle' (°)	base_angle (°)
-5, 10, 23	0	10.96	18.41	60.62	116.56
4, 8, 25	-45	-11.57	60.71	-4.14	63.43
4, -6, 20	30	-15.49	46.31	89.18	-56.31