

Case Study 1: Consider simple anthropomorphic arm in Fig.1. Several practical uses of this arm can be seen in [1](#) and [2](#).

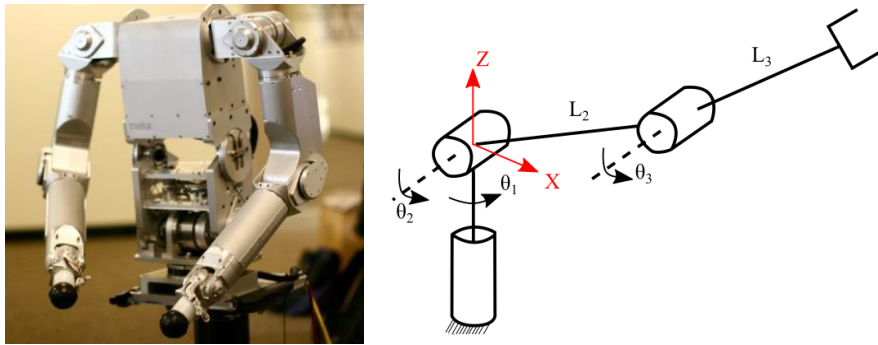


Fig 1. Kinematic Structure of the simple anthropomorphic arm

Case Study 2: Palletizing is a demanding application of stacking boxes, bags, cases, bottles, and cartons onto pallets as the last step in the assembly line before being loaded onto a shipping truck. A schematic of a 3-DOF [palletizer robot](#) can be seen in Fig 2.

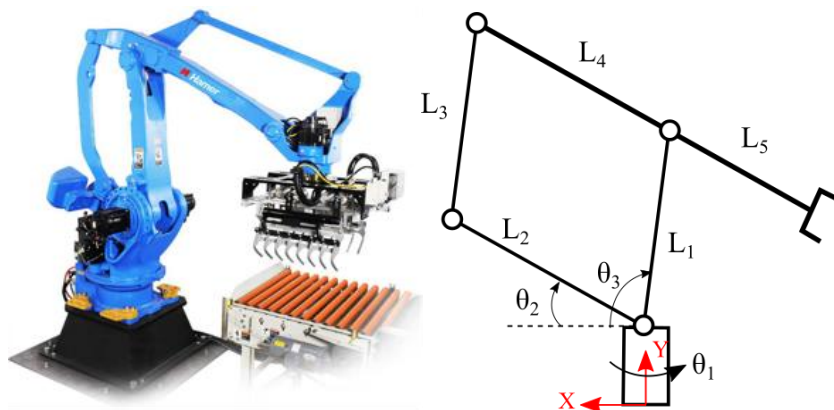


Fig 2. Kinematic Structure of 3-DOF palletizer robot

Project: Consider a 3-DOF parallelogram-based robot in Fig.1. Such kinematic Structure has been used in many surgical robots such as [Da Vinci](#) and [PRECEYES](#).

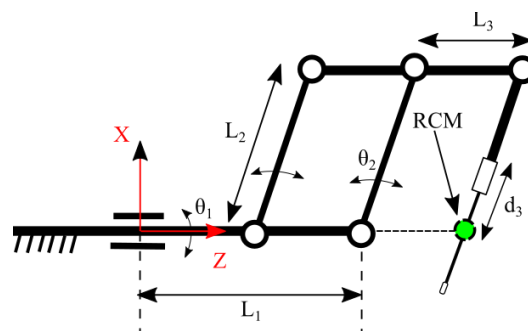


Fig 3. Kinematic Structure of 3-DOF parallelogram-based robot. To better understand the above schematic, see this [link](#).

1. Derive the screw-based Jacobian matrix for the first case study.
2. Derive the conventional Jacobian matrix for the second case study.
3. Derive both the conventional and the screw-based Jacobian matrix for the project part. The result should be identical.

Late homework policy: Please submit your assignments on time, in case you run out of time, you can still send it as late submission only by one day with the expense to lose some marks depending on the time you submit your work.

Collaboration policy: Collaboration with humans is very beneficial but restricted to the “whiteboard level”, meaning that we recommend you to discuss approaches and solutions with your peers, but write your code, reports, and analytical derivations by yourself.

How to submit: Zip your files within the format of HW#_Name_StudentID, and submit them to the LMS website.

Contact us through Email: ta.robotics.1399@gmail.com

Good Luck!