NAME MT-15

COURSE ENAR 4020

DATE

LESSON Mechanical Design 2

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Mechanical Design Fundamentals

Strategy for creating novel designs

↳ divide problem into simpler sub-problems

↳ Apply well known solutions to simple problems (not all solutions need to be unique, or from scratch)

↳ make modifications to meet design requirements

↳ optimize

More Mechatronics Mechanical Design Axioms

Axiom 4: Locate actuators as close as possible to what is being actuated

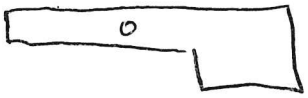
Axiom 5: Try to reduce degrees of freedom

Axiom 6: Avoid asymmetry in design

↳ avoid pulleys, cables and ropes, that slip

↳ exceptions

Ex! Object dropper



explain with words

Axiom 7: A robot cannot control what it cannot sense

Axiom 8: Reduce weight whenever possible but don't allow things to be flimsy

Axiom 9: use gravity if possible → if you can build potential energy early, then gravity can achieve object motion after

Basic Building Blocks of Robots for course

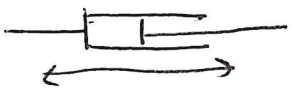
1. object collector
2. sorter/color detector
3. bins for each color
4. object delivery

ON top of navigation system

Robot Mechanisms

Joint Primitives and Serial Linkages

- A Robot mechanism is a multi-body system
  - ↳ each rigid body in a robot mechanism is called a link
  - ↳ combination of links is called a linkage
- two primitive connections between links
  - ↳ prismatic → pair of links makes translational displacement along a fixed axis



↳ revolute – pair of links rotate about a fixed axis

(hinge, articulated, rotational joint)

Articulated Robots

goal → locate object in space

- cartesian robots
  - ↳ all prismatic joints

3 links

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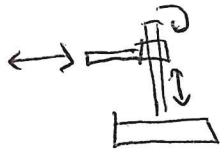
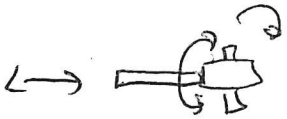
- Cylindrical
  - two prismatic, one revolute

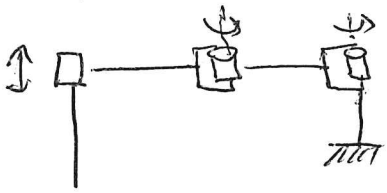


- Spherical
  - two revolute, one prismatic

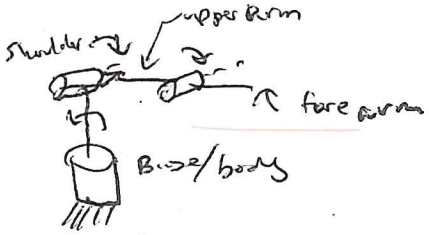


- other ways of locating an end effector in space

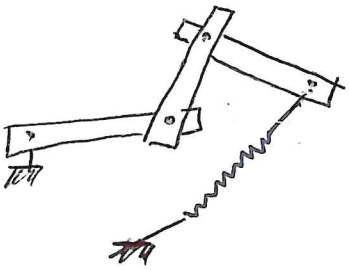
SCALAR (one P, 2 R)



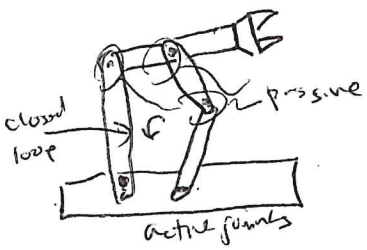
Elbow Robot



Mass balancers



Parallel Linkages
- consists of both passive and active joints



more than 2 active joints would cause conflict