Robotics Notes

1/28/20

Locomotion and Forward Kinematics

* Early submission: 2 extra points per day (up to a week early; 14 points)
* Late submission: Lose 2 points a day (up to a week late)
* Recap: State, Action, Transition Function, Reward Function, Uncertainty
* Recap: Position, speed, velocity, jerk
* Robots need a model of the world
  + This means they must know where they are in the world
  + They also need to know what is immediately around them
  + Often there is a goal
  + BE PRECISE
  + To uniquely identify an object in the world you need:
    - X, Y, Z -- Where you are
    - Yaw, Pitch, Roll – How they are facing
    - This is what we call Operational Space
* Degrees of Freedom (DoF)
  + To be completely free, you need to be able to move in all six directions listed above
* Human Arm
  + DoF in Operational Space: 6
  + DoF in Joint Space: 7 (3 in shoulder; 1 in elbow; 3 in wrist)
* Redundancy: When your DoF in joint space is higher than your DoF in Operational Space
  + This is a good thing; it allows you to avoid obstacles and choose the optimal route
  + For example: We can grab off a table from many angles but we choose the one that is easiest on our joints and minimizes energy consumption
* Bicycle
  + DoF in Joint Space: 2 (pedal and steer)
  + DoF in Operational Space: 6
* Forward Kinematics: Given my robots configuration, where is my hand?
* Inverse Kinematics: If I want my hand to be in X position, how do I configure my robot?
* Coordinate System:
  + RHR -> Thumb represents X, Pointer Finger represents Y, Middle finger represents Z
    - Look at diagram in slides
  + By following the Right Hand Rule, we can make sure everyone is on the same page

TAKEAWAYS: Degrees of Freedom was the main topic; then we transitioned into coordinate systems