*Presentation*

**Kinematics** = Looking at motion (without considering forces causing the motion)

* Forward kinematics – predicting location of effector given lengths and angles
* Inverse kinematics – predicting the angles of the effectors given the lengths

Goal: Get an end effector of a robot to a desired position, trying to prevent rigid bodies moving

the end effector from colliding with things in its environment

**Geometry**

Working in three-dimensional space (Cartesian Coordinates)

Orthonormal Frame = Origin (any point) + 3 Orthonormal vectors)

* + - Sometimes easier to describe position of a point with regards to neighboring point

Forwards Kinematics

Very straightforward – especially in 2d, given the relative angles that the rigid bodies are to each other, we can use the equation:

*(x,y) = (L1cos(theta1) + L2cos(theta1 + theta2) + L3cos(theta1 + theta2 + theta3),*

*L1sin(theta1) + L2sin(theta1 + theta2) + L3sin(theta1 + theta2 + theta3))*

Inverse Kinematics

Solvable in 2d – given (x,y) find theta1, theta2

* + Technique – Use the rule of cosines

Homework

* Implement forward and inverse kinematics for 2R and 3R robot detailed in slide 23 (with documentation and tests). Other expectations are also written on this slide.
* To get you started, I proposed an interface for the robots that you will find in the file robot.py. Feel free to change it if it doesn't fit what you had in mind