Robot/Environment Interaction

- Come see the Boxter! Drone in a sense that it moves through space
- Degrees of Freedom: Equation \( \rightarrow \) input: angles, output:
  position in space/cartesian plane coordinates
  corresponds to arm movement, angle
- Forward Kinematics: angle \( \rightarrow \) joint coordinates
- Inverse Kinematics: joint cartesian coords input \( \rightarrow \) angle

\[
\begin{align*}
xy^2 & : \text{roll (rotating)} \\
\text{pitch} & : \text{twisting around each axis} \\
\text{yaw} & : \text{how we specify positions}
\end{align*}
\]

\( \rightarrow \) 6 degrees of freedom

Boxter has 7 degrees of freedom!
Costs $30,000

PR2 costs $400,000 \( \rightarrow \) what robot would you buy?

Curiosity \( \rightarrow \) Mars rover... autonomy is not a choice...
Air Drone \( \rightarrow \) buy online, control w/ phone

- Autonomy: When something "goes by itself", makes its own decisions
- Teleoperated: Human controlled

Is autonomy so far off? We use it all the time!
- Temperature control in houses
- Gas burners/plugs = "automatic oven"
- Solar panels gather electricity

What is a robot anyway?
- An autonomous machine
  - Planning/decision-making
  - Changes position, moves through space
- Machine that performs a task

In robotics lab as a researcher!
Is the microwave a robot?

Robot: device w/ sensing, actuation, and computation

Robotics -> the degree to which you are a robot, there is a range for everything.

Safety:
- FAA regulations -> outside
  - Helicopter/plane crash
    - How could this happen?
    - Air traffic controller didn’t check to see if the # was right
  - Special rules for model aircraft
    - Recreational use