What is a Robot?

- a mechanism guided by automatic controls
- a device that automatically performs complicated often repetitive tasks
- a machine that looks like a human being and performs various complex acts (as walking or talking) of a human being; also a similar but fictional machine whose lack of capacity for human emotions is often emphasized

Is This a Robot?
How ‘Bout Now?

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We Can All Agree on This Guy
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But What About This Guy?

- Automatically Performs Complex Tasks
- Repetitive Actions
- Looks Like a Human
- Has Mechanical Sensors

...And What About This Guy?
Mind Children

*Hans Moravec*

Robot: Mere Machine to Transcendant Mind

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Moore’s Law

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Essential Ingredients of Robots

- **Perception**
  - A Robot must be able to Sense the World
- **Cognition**
  - A Robot must be able to React to those Sensations
- **Manipulation**
  - A Robot must be able to Affect the World

*Carnegie Mellon University, Robotics Institute*
Welcome to Intro to Robotics

- **Lecture Course**
  - 3 credits
  - ENGR 3730
  - Homeworks, Exams
- **Lab Course**
  - 1 credit
  - ENGR 3731 (3800)
  - Labs, Projects
- Not required to take both

This is Our Goal

More Logistics

- **Class Meets**
  - MW 7:00 – 8:30
  - Room: here
- **Final Exam is planned**
- **Lab Meets**
  - Th 5:00 – 8:00
  - Room: CMK 100
And Still More Logistics

- Web Page is Your Responsibility
  - [http://www.engr.du.edu/richard/Classes/ENGR3730/index.html](http://www.engr.du.edu/richard/Classes/ENGR3730/index.html)
- Matlab or C programming
- Grading subject to change
  - Always ask how you’re doing

And the Un-Fun Part

- Academic Dishonesty
  - Not tolerated
  - Flunk the course, period
- What is plagiarism?
  "In short, to plagiarize is to give the impression that you have written or thought something that you have in fact borrowed from another."

What Do I Do?

- Self-Adaptation
  Byung Hwa Kim
  Colin D’Souza
  Nohhyun Park
  Prof. Stergios Roumeliotis
  "Both SW and HW Self-Adaptation"

- Applications
  - Planetary Exploration
  - Search and Rescue
  - Surveillance
  - Locomotion
  - Rubbled Terrain
  - Multiple Modes
  - USAR Amy Larson
  - Jaewook Bae

- Byung Hwa Kim
  Nohhyun Park
  Colin D’Souza
  Prof. Stergios Roumeliotis
CRAWLER Scout Video

Mechatronic Systems that See and Feel – Richard Voyles

Microassembly at the Planar Scale
- Precision Attachment (solder, UV epoxy)
- Stacked MEMS Devices

Programming by Human Demonstration
- Task Expert vs. Programming Expert
- Machine Learning
- Self-Calibration

Search-and-Rescue Robots

Mobile Manipulation
- Intelligent Kitchen
- Assistance to Elderly and Handicapped
- User Interfaces

The Works Museum Robot

- Planar
- Simple cuts (can be created on a table saw)
  - Inexpensive
  - Easy to replace parts
- Easy access to inner parts
- Very sturdy
This is Our Goal

Outline

- Robot Control (Ch 9)
- Trajectory Generation (Ch 7)
- Transformations (Ch 2)
- Kinematics (Ch 3)
- Inverse Kinematics (Ch 4)
- Jacobians (Ch 5)
- Dynamics (Ch 6)
- More Trajectory Generation (Ch 7)