

Industrial Robotics

Jane Li

Assistant Professor

Mechanical Engineering Department, Robotic Engineering Program

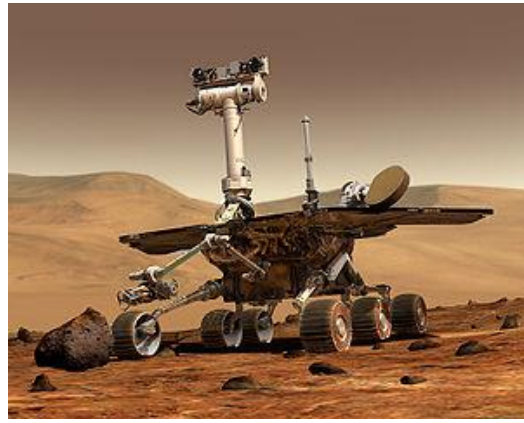
Worcester Polytechnic Institute



Overview

- Introduction
- Course logistics

Applications of Advanced Robotics Technology



Applications



Applications



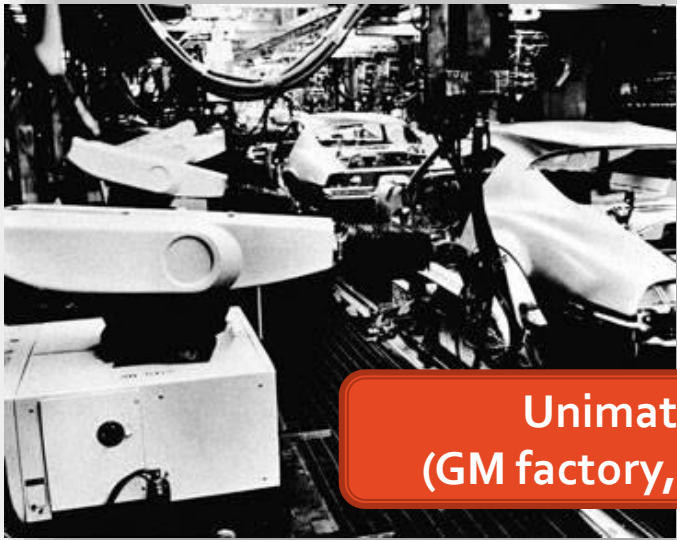
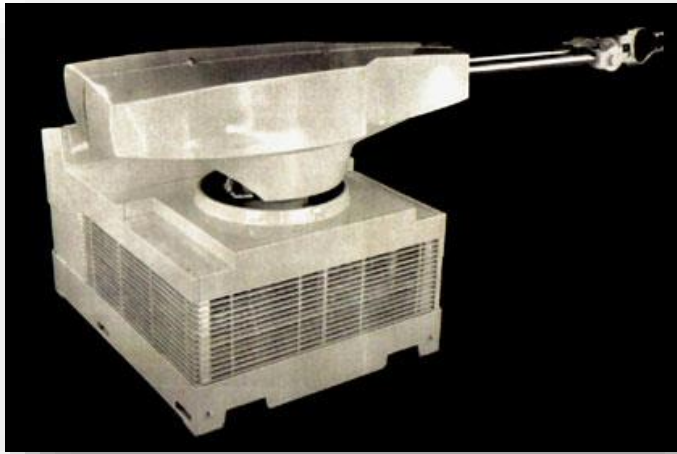
Applications



Industrial robots

- The largest commercial application of robotics technology
- Year of 2014
 - Estimated installation = 1.5 million units
 - 171 000 new installations
 - Estimated annual turnover of the robotics industry = \$ 32 billion

Development over 50+ years



Unimate
(GM factory, 1961)

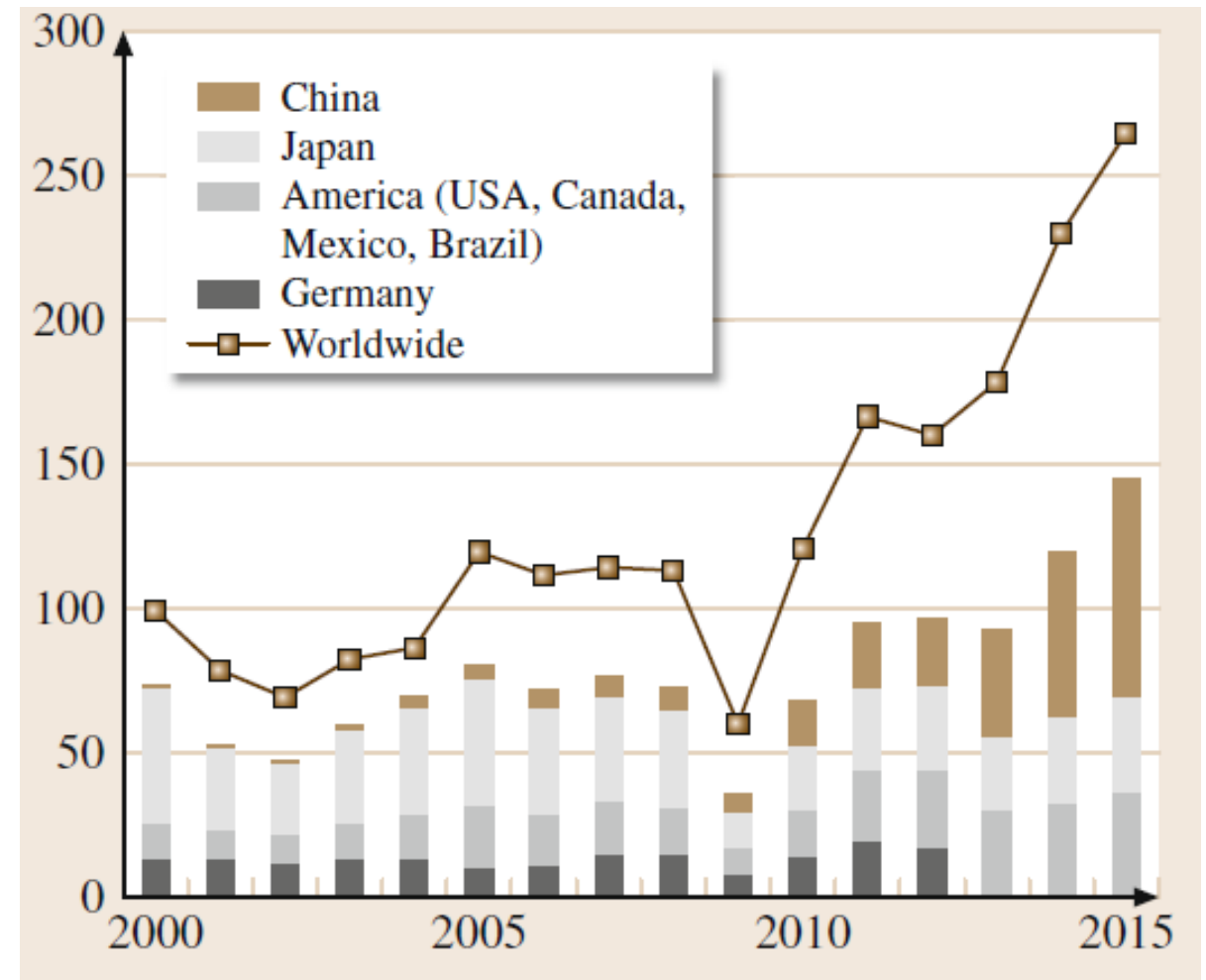


Tesla Robots



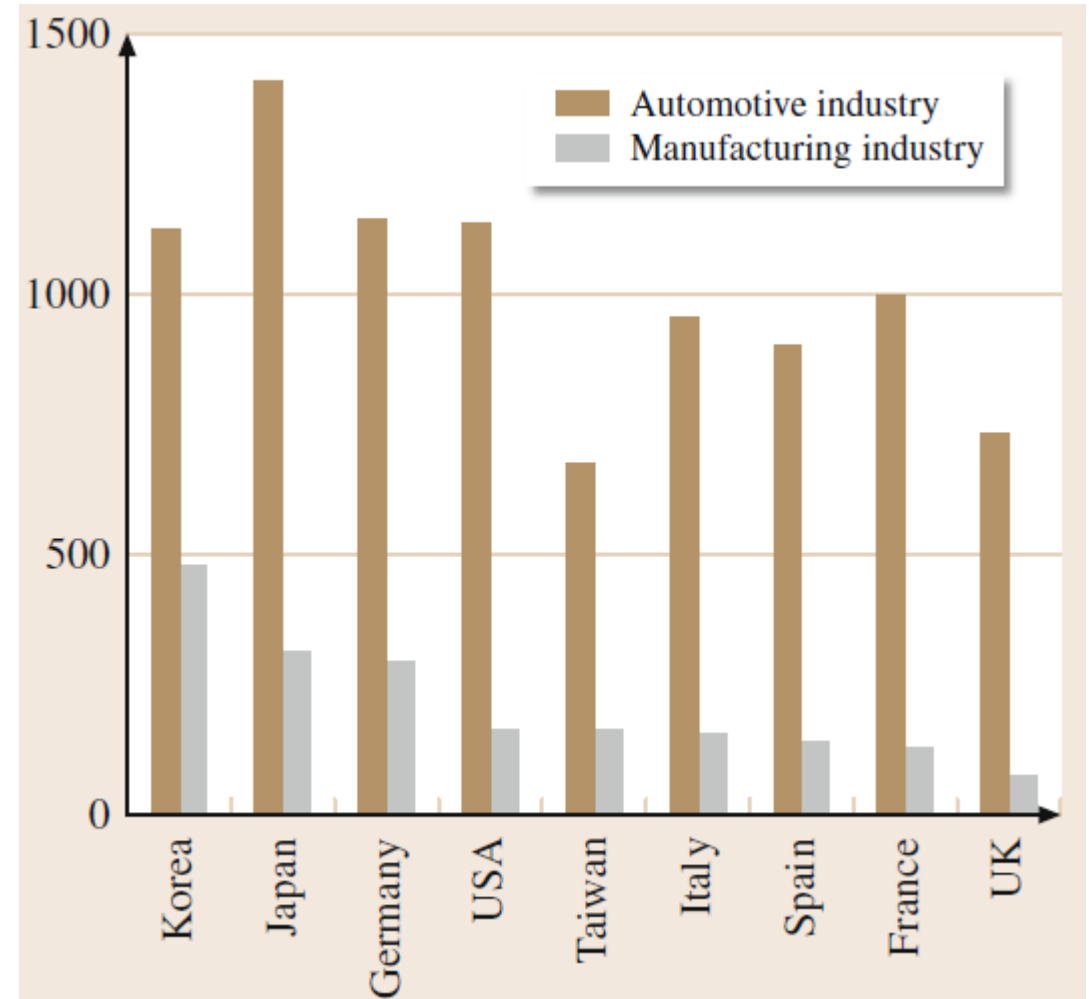
Statistics of Worldwide Industrial Robot Use

- Estimated annual robot installations (2015)
 - 1000 units



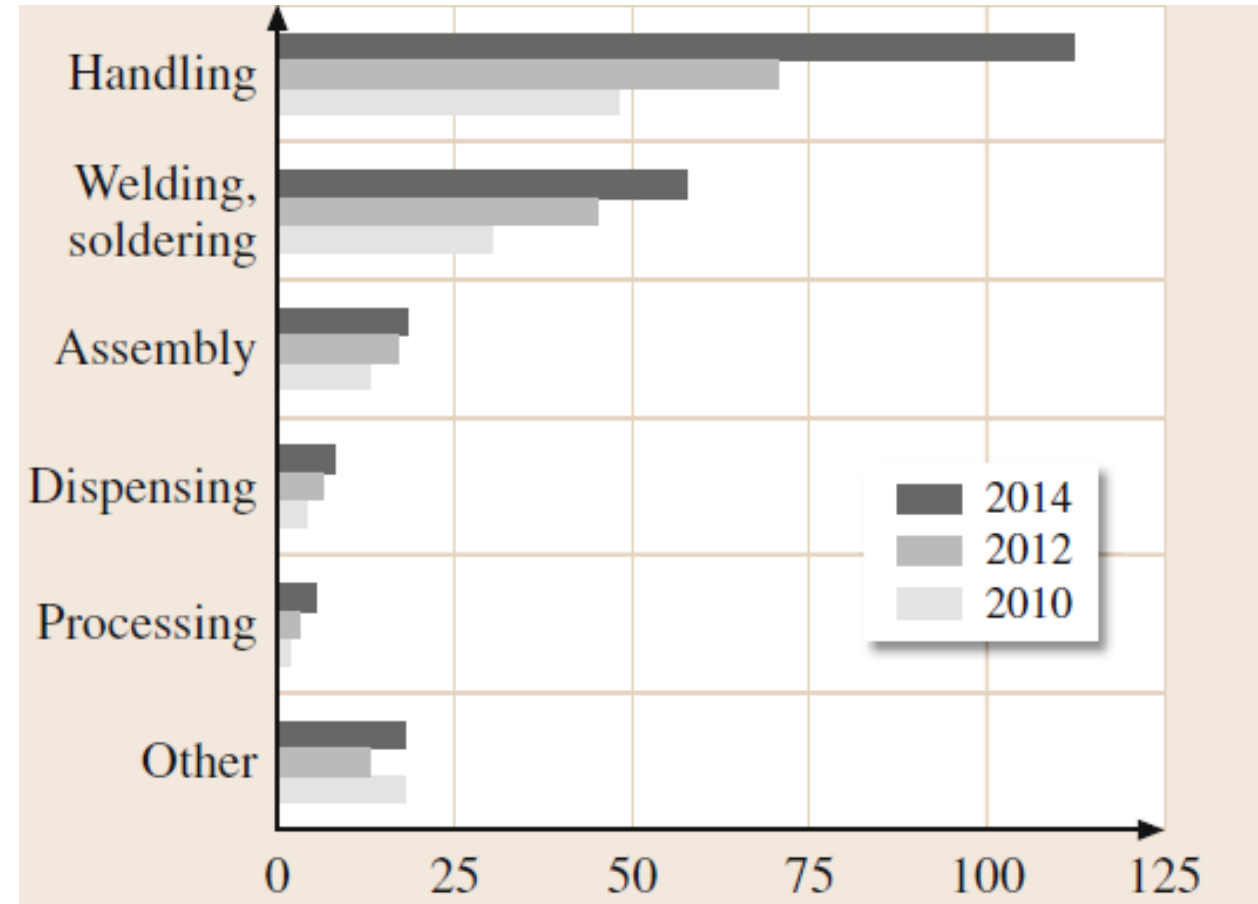
Statistics of Worldwide Industrial Robot Use

- Number of multipurpose industrial robots (all types) per 10,000 employees in the automotive and in manufacturing industries (2014)



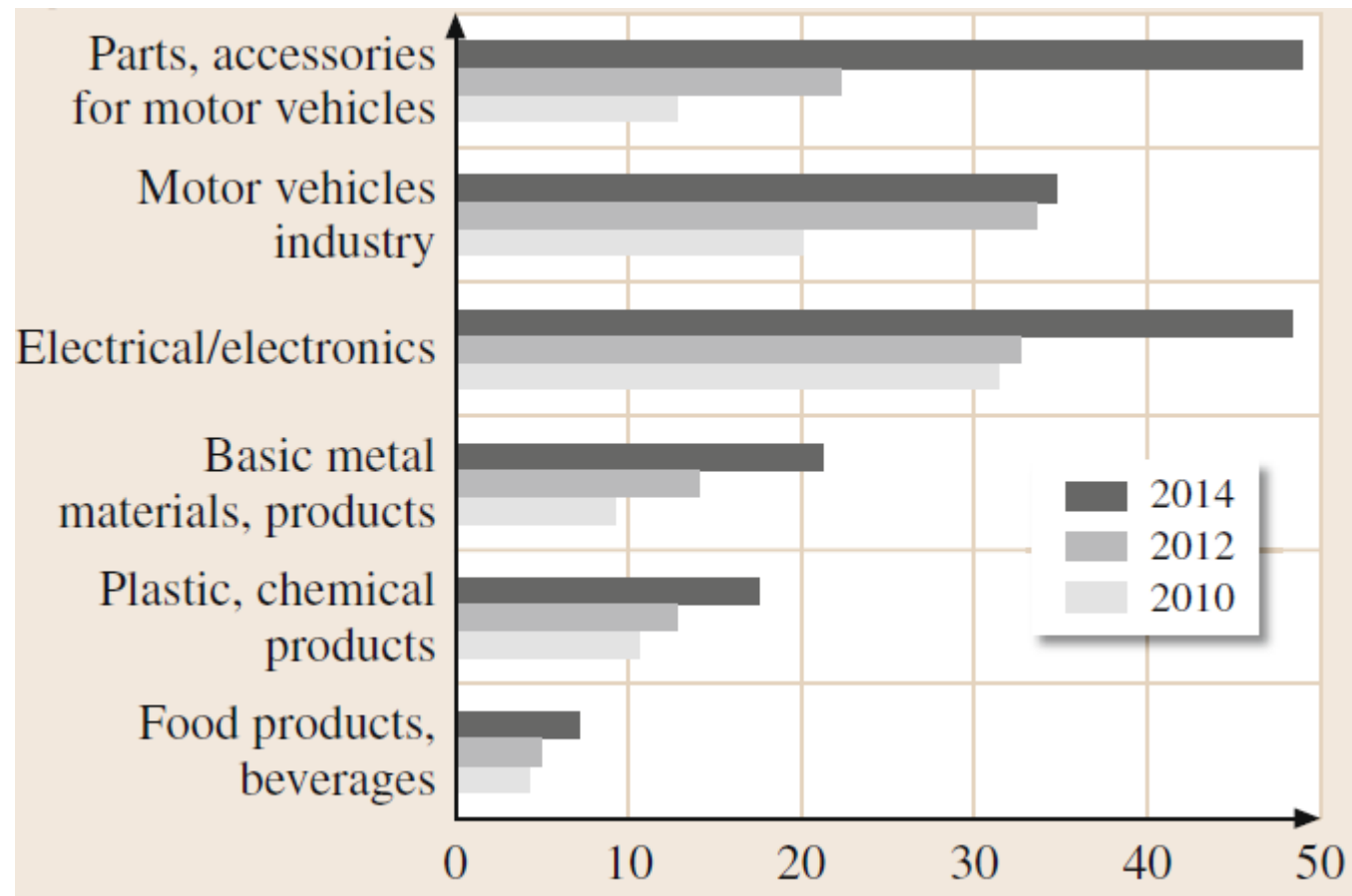
Statistics of Worldwide Industrial Robot Use

- Estimated worldwide annual shipments of industrial robots in main application areas (2014)



Statistics of Worldwide Industrial Robot Use

- Estimated worldwide annual shipments of industrial robots in main industrial branches



Latest Technology Industrial Robots



Industrial robots

- Foundations for robot motion planning and control
- The origin of robotics science
- Many unsolved problems

Scope of this course

- Theory
 - Robot geometry, transformation, forward and inverse kinematics
- Practice
 - Robot Studio – program ABB robot for your project tasks
 - Selected topics
 - Typical Industrial Robot Applications
 - Safe Human–Robot Collaboration
 - Robot Teaching and Programming

Connection to Other RBE Courses

RBE 550
Motion
Planning

RBE 4815
Industrial
Robotics

RBE 500
Foundation of
Robotics

RBE 501
Robot
Dynamics

RBE 502
Robot Control

Course logistics

Primary Instructor

- Jane Li (zli11@wpi.edu)
- Research website
 - <http://users.wpi.edu/~zli11/index.html>
- Office hour
 - 85 Prescott 223C
 - 2:00-3:00pm, Wednesday & Friday
- Responsibility
 - Cover most of the lectures (except for Robot Studio)
 - Co-advice course projects



Instructor

- Craig Putnam (cbputnam@wpi.edu)
- Research website
 - <https://www.wpi.edu/people/faculty/cbputnam>
- Office hour
 - 85 Prescott 208
 - TBD
- Responsibility
 - Cover the tutorial for Robot Studio
 - Advice course projects



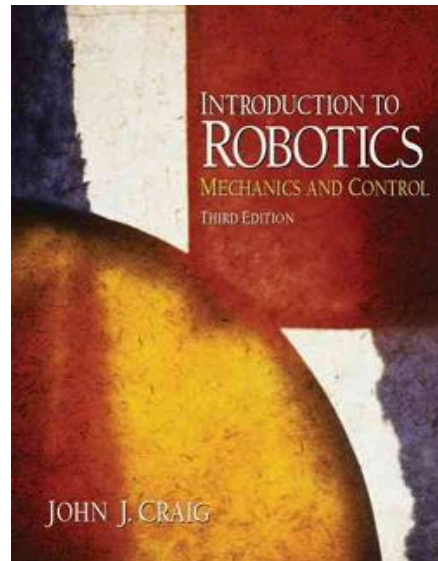
Our TA

- TA – Office Hours: by appointment
 - Adam Gatehouse (ajgatehouse@wpi.edu) – sitting in the lectures
 - Ryan Mocadlo (mocad@wpi.edu)
- Responsibility
 - Grading course work
 - Manage labs
 - Technical assistants for your final course projects
- Friday – Introduction to labs (hosted by TA)

Course information on Canvas

- Course syllabus
- Course schedule ([link](#))
- Course relevant discussion

Reference Books



Grading

- Homework 10%
- In-class quiz 5%
- Exams 20%
- Project 40%
 - Progress reports (5%); Final report (15%); Final presentation (15%);
 - Peer evaluations (2.5%); Presentation evaluations (2.5%)
- Laboratory Participation and Completion 10%
- Laboratory Reports 15%

In-class quiz

- Quiz every lecture!
 - The beginning of the course
- Study for quiz
 - Review previous lecture slides
 - Do assignments
- Make sure your hand-writing is readable

In-class participation

- Participation matters!
- Attending lectures
 - Count your attendance by quiz submission
- Ask and answer valuable questions **in class** and **on Canvas**
 - TA will take notes in class and count Q&A on piazza
- Help each other in projects
 - Teammates will evaluate each other)

Important Dates

- Mar 19 Teams formed
- Mar 26 Project Proposal Due
- Apr 2 Progress Report #1 Due
- Apr 9 Exam #1
- Apr 16 Progress Report #2 Due
- Apr 23 Exam #2
- Apr 24, 26, 27 Final Presentations
- May 1 Final Report Due (@ noon)

Course work submission

- Policies applied to all the submission for this course
- Submission on Canvas
 - File name = use **[LastName]_[FirstName]_[submission content]**
 - Multi-file submission: include all document in a **Single** zip file
 - Single-file submission: submit file directly
 - **Team work - submit only one copy, include the names of all teammates.**

Course work submission

- Policies applied to all the submission for this course
- Submission on Canvas
 - File name = use **[LastName]_[FirstName]_[submission content]**
 - Multi-file submission: include all document in a **Single** zip file
 - Single-file submission: submit file directly
 - **Team work - submit only one copy, include the names of all teammates.**

Lab and course project team

- Please form teams of 3 – 5 class members before **March 19**
- Teams will be used for the lab and course project
- All team members should be present for each lab
 - Consider this when booking the lab time slots for your team

Introduction to lab and course projects

- The proposal for the project is due on **March 26**.
- Lecture on **Mar 16 (this Friday)**
 - Introduction to labs and course projects
 - Guideline for choosing your final project topics
 - Orientation to lab resources

Important!

- Submitted before noon of the due date.
 - Do not count late submission
- Check Course Schedule *frequently* for most up-to-date submission date
- Check your grade *frequently*. Before the end of the course, you can
 - Attend **office hour** if you need help
 - Ask for **extra work** if you want to make up for your low grade
- Keep in touch with instructor, TA, project team
 - Make sure you teammates know what you are working, because **they will evaluate you in the end.**

Assignment 1 – Choose your teammates

- Network with your classmates
- Understand their project experience and skill set
- Form your team
- Discuss potential course project topics

End
