[L1] Robotics (ME671):
Course description

Suril Shah
IIT Jodhpur

Instructor

Suril Shah
Assistant Professor
Mechanical Department

Office: 3108, Academic block
Email: surilshah@iitj.ac.in
Web. http://home.iitj.ac.in/~surilshah
http://surilshah.weebly.com/
Extension: 209

Course time

• Lecture Hours:
  Monday, Wednesday, Friday: 12:00 pm

• Office hour : Tuesday 4-5 pm
  (Drop me an email )

Pre-requisite

• Basic mechanics
• Basic linear algebra
Tentative Course Plan

- By Mid 1: Some fundamentals, Rigid Motions and Homogeneous Transformations, Forward and Inverse Kinematics, Jacobian
- By Mid 2: Path and Trajectory Planning, Robot Modelling and Simulation, Robot Position Control
- By End-Sem: Computer vision, Vision Based Control, Special topics on Wheeled Robot and Quadcopter

Course webpage:
- [http://surilshah.weebly.com/me671.html](http://surilshah.weebly.com/me671.html)

Tentative Course Evaluation Plan

- Mid-term 1 (20%)
- Mid-term 2 (20%)
- End-sem (42%)
  - End-sem exam 30%
  - End-sem project 12%
- Others (18%):
  - 3 assignments (3%)
  - 6 programming assignments (6%)
  - 3 surprise quizzes (9%)

Grading

- A grade: Absolute (> 80%)
- Other grades: Relative to A grade
- Attendance policy: As per the institute rules

Academic Code of Honours: Visit course page
- [http://surilshah.weebly.com/me671.html](http://surilshah.weebly.com/me671.html)
  (http://faculty.iiit.ac.in/~vikram/reveal/honour.html#/)
Course Objective

• To introduce fundamental aspects of modeling and control of robot manipulators.

Toys of medieval time

[Images of toys]

The da Vinci humanoid robot (1495)

• Rediscovered in the 1950s
• Model inner workings, as displayed in Berlin

[Images of the da Vinci robot]

Mechanical Horse

• William Goodwin (1867)
• L A RYGG (1893)

[Images of mechanical horses]
Got publicity in 1921
Rossum’s Universal Robots (RUR)
by Karel Capek

Later in 1950
I Robot
By Isaac Asimov
Wrote 3 Laws of Robotics

First industrial robot (1961)

The original notion of a robot was the manipulator arm
used in factory automation.

Shakey (1969)

- First autonomous robot
- It had
  - Camera
  - Range finder
  - Bump detector
  - On board logic

Dynamically balanced robot
(1976)

https://www.youtube.com/watch?v=XFXqJ1mvln8
Intelligent Robot (2008)

Runs at 4mph, Climbs 25 degree slopes, Carries 155kg loads

https://www.youtube.com/watch?v=W1czBcnXIWW

The Notion of What Qualifies as a Robot has Changed Greatly Over the Years

http://koleksirobot.blogspot.in/2011/06/robot-asimo.html
http://www.theengineer.co.uk/in-depth/surgeon-turned-minister-ara-darzi-discusses-his-vision-for-the-future/304203.article
http://www.tomsguide.fr/actualite/robot-serpent,19232.html
http://en.wikipedia.org/wiki/Mars_Exploration_Rover
http://housewares.about.com/od/vacuumreviews/gr/iRobotRoomba500.htm
http://www.pagines.fib.upc.es/~rob/protegit/treballs/Q2_03-04/submarinos/index.htm
http://www.newscientist.com/article/dn8802-robotic-pack-mule-displays-stunning-reflexes.html#.UsJ8zfQW0zM

So, to be called a robot, an entity must
• be a machine, capable of doing real work
• operate in a closed-loop fashion under computer control

What are the Attributes of a Robot?

Environment
Acting
Sensing
Thinking
A Robot
- Gathers Information about its Environment - Sensing
- Processes that Information to Make Decisions - Thinking
- Performs Work on the Environment - Acting

http://www.utdallas.edu/~mspong/Presentations/CSL%2060th%20Anniversary%20lecture.ppt

A Robot is a Mechatronic System at the heart of which is Feedback Control.
Feedback Control allows:
• Autonomy
• Performance in Unstructured Environments
• Learning
Is humanoid the ultimate Mechatronic System?

- It has mechanics (hands, arms, legs)
- It has sensors (cameras, force, touch)
- It has a brain (computer)
- It incorporates feedback control (actions are based on sensed quantities)

Way forward

http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-832-underactuated-robotics-spring-2009/video-lectures/lecture-1-introduction/

Why should we study ROBOTS/ROBOTICS?

Industrial automation

Hazardous and emergency environments

https://images.google.com/
Surveillance and Exploration

Locomotion

Entertainment

Agriculture

Construction

Simulator

Search & rescue
What is this course all about?

- How to define geometry of a robot
- How is motion of a robot planned?
- How is robot modeled mathematically?
- How to control a robot?
- How robot can be controlled through computer vision?
- How do we control wheeled and mobile robots?
THANK YOU