6.01

Lecture 14: Wrap-Up

Lecturer: Adam Hartz (hartz@mit.edu)

As you come in...

- Grab one dhounat
  (if you have filled out your subject evaluation)

`http://mit.edu/subjectevaluation/`

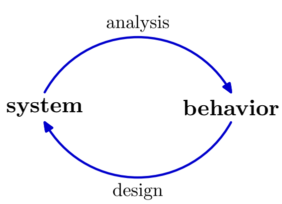
Notes

6.01: A Look Back

The **intellectual themes** in 6.01 are recurring themes in engineering:

- design of complex systems
- modeling and controlling physical systems
- augmenting physical systems with computation
- building systems that are robust to uncertainty

In short, 6.01 is about **engineering design**.



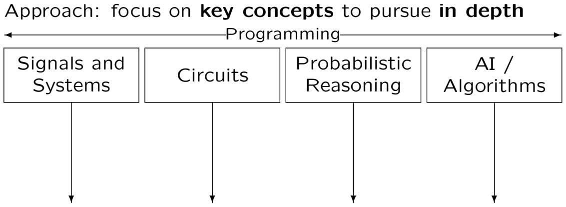
Notes

6.01: A Look Back

6.01 is organized into four modules:

- Signals and Systems
- Circuits
- Probabilistic Reasoning
- AI / Algorithms

Approach: focus on **key concepts** to pursue **in depth**

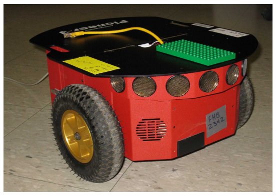


Notes

6.01 Pedagogy

Most of the learning is in the lab!

- active learning with hands-on exercises
- open-ended problems with multiple correct solutions
- multiple levels of individualized help
  (partners, LAs, TAs, Instructors)



Intellectual themes are developed in context of a mobile robot.

Notes

Guiding Principles

David Merrill's **First Principles of Instruction**

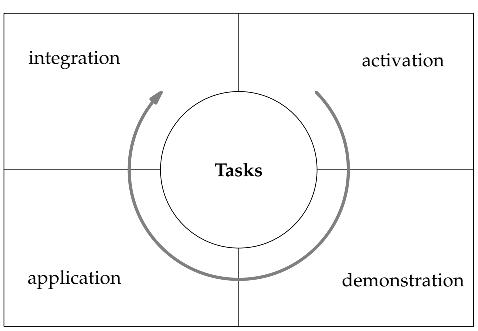
Students learn best when they...

- **task-based**
  ...acquire skills in the context of solving real-world problems
- **activation**
  ...activate existing knowledge and skills as a foundation
- **demonstration**
  ...observe a demonstration of the skill to be learned
- **application**
  ...apply newly-acquired skills to solve problems
  ...receive expert feedback on their work
- **integration**
  ...reflect on, discuss, and defend a newly-acquired skill

Notes

Guiding Principles

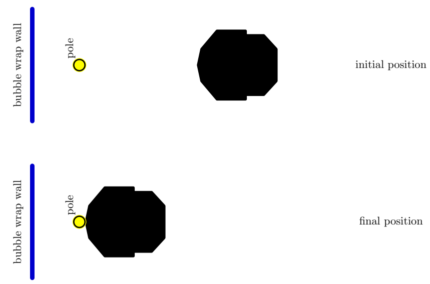
Merrill's First Principles of Instruction



Notes

6.01: Day 1

Challenge: Get to the pole as quickly and closely as possible, without knocking the pole over.

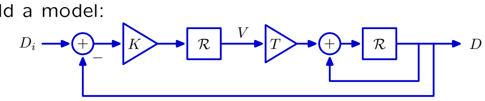


Notes

6.01: Day 2

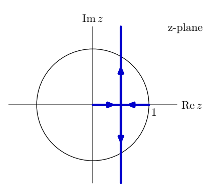
Now we are now primed to learn the theory.

Build a model:



Analyze the model:

$$\mathcal{H} = \frac{D}{D_i} = \frac{KT\mathcal{R}^2}{1 - \mathcal{R} - KT\mathcal{R}^2}$$



Notes

6.01: Projects

Fundamental themes taught through hands-on labs with concrete, authentic engineering applications.

- Wall-finding Robot
- Jousting Robot
- Servo Motor and Light Tracker
- Pet Robot
- Circuit Solver
- Parking Robot
- Solving Mazes
- Word Ladder
- Navigating Robot Through Known Maze
- “MapQuest”
- Navigating Robot Through Unknown Maze

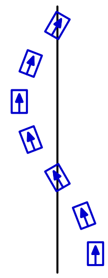
Notes

Module 1: Signals and Systems

Modeling and analyzing behavior of physical systems

Focus On: Discrete-time feedback control systems

Wall-finder, Wall-follower, Jousting



Next Courses: 6.003, 6.011, 6.302

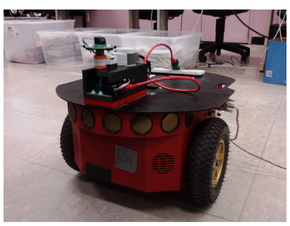
Notes

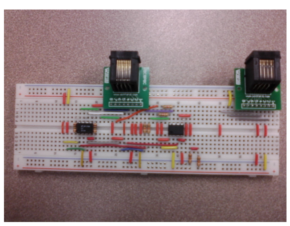
Module 2: Circuits

Designing, constructing, and analyzing physical systems

Focus On: Resistive Networks, Op-Amps, Linearity

Design a new sensory modality for the robot





Next Courses: 6.002, 6.007, 6.012, 6.131, 6.021

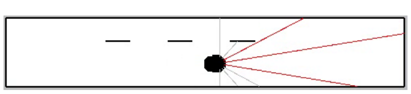
Notes

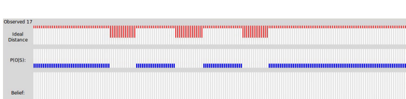
Module 3: Probabilistic Reasoning

Modeling uncertainty and desiging robust systems

Focus On: Subjective Probability, Bayesian Inference

Localization: Find location in known hallway





Next Courses: 6.008, 6.036, 6.438/6.437

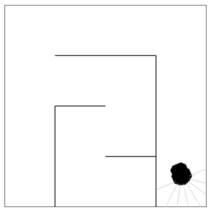
Notes

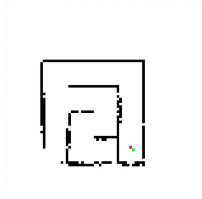
Module 4: Software Engineering

Thinking about and controlling complexity

Focus On: Graph Search Algorithms

Robot maze solver, USA Path Planning





Next Courses: 6.034, 6.006, 6.046, 6.009

Notes

Building and Modeling Complex Systems

Modularity and Abstraction:
Primitives, Means of Combination, Abstraction

- **Data**: lists, dictionaries, objects
- **Procedures**: function composition and definition
- **Polynomials**: add, mul, . . .
- **Signals**: add, scale, delay
- **Systems**: cascade, parallel, feedback, $\mathcal{R}$
- **Circuits**: series/parallel, I-V curves, Thévenin, op-amps
- **Search**: successors, tree representation
- **Probability**: joint, condition, marginalize, Bayes' Rule
- **Distributions**: delta, uniform, triangle

Notes

Feedback!

Your feedback is important to us!

Please share your feedback!

`http://mit.edu/subjectevaluation/`

Notes