

RICE ELEC 201 DESIGN COURSE*

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Abstract

A synopsis of the Introduction to Engineering Design course at Rice University, Houston, Texas.

The Rice University Electrical and Computer Engineering Department offers a course called ELEC 201 *Introduction to Engineering Design*, known informally on campus as **LEGO Lab**. This hands-on course immerses students in an engineering design and problem solving team experience that exposes them to the challenges and rewards of practicing engineers. The course targets two groups of students. First, freshmen and sophomores who are considering an engineering major but who want more information on the principles of engineering design and on professional practice. Second, non-engineering majors who want to experience and understand the design process that creates the technology that permeates today's economy, society, and political decisions. The course is completely self-contained, assumes **no prerequisites**, and is intended for all majors. At present it is not a required course for any engineering major.

In the course, teams of three students design, construct, and program a small autonomous robot to engage in a competition at the end of the semester. An example of a robot is shown in Figure 1 (The 2000 Winning Robot "Stone Cold").

*Version 1.1: Apr 27, 2006 1:41 pm GMT-5

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The 2000 Winning Robot "Stone Cold"

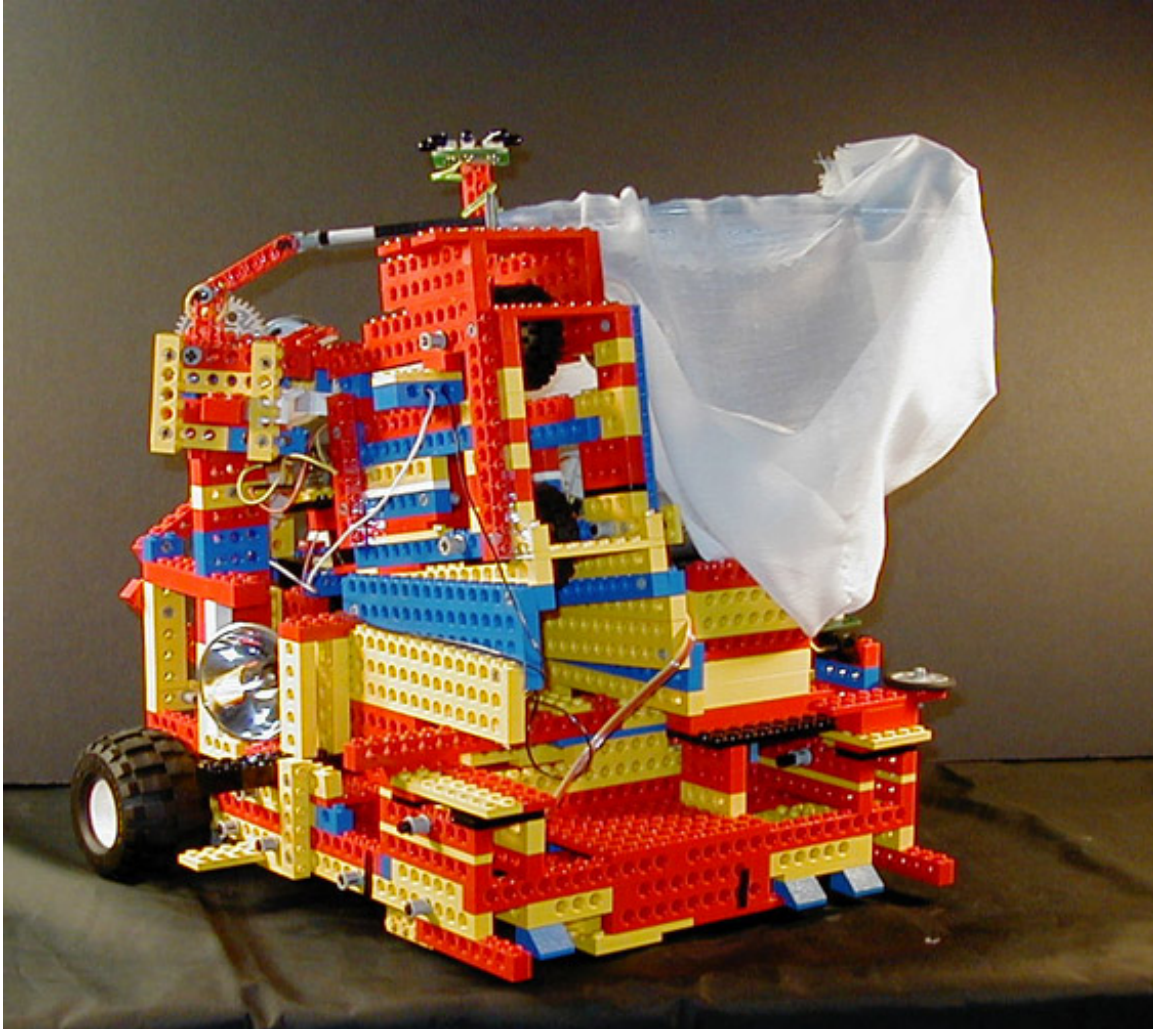


Figure 1: The robot is assembled from LEGO building blocks, electro-mechanical components, sensors, and a microprocessor. It must be able to navigate around the playing surface and successfully interact with game objects, including the opposing robot, all without human intervention.

The engineering challenge for each team is to devise a game strategy, and to design and build the mechanics and software to implement their strategy within the rules of the game and the available materials. During the process the participants are exposed to issues that confront every practicing engineer, such as working within constraints, using available technology, design tradeoffs, iterative design, team dynamics, and meeting project specifications, milestones, and time constraints. We have developed an extensive set of class notes that is available on the course web site, and we are slowly transferring it to Connexions. Information on the notes¹.

¹"Rice ELEC 201 Course Notes Project" <<http://cnx.org/content/m13597/latest/>>

ELEC 201 is not really a robotics course. Instead, it uses a project involving a small robot to create a realistic, and fun, design problem. On a more formal basis, the real subject of the course is **process**: the process of problem solving; the process of design, the process of project management, and the process of team building and dynamics. We also include exercises on engineering professionalism, engineering ethics, intellectual property, and what can be learned from engineering failures.

1 Course Development

ELEC 201 was developed and initiated at Rice by Dr. John K. Bennett in 1994. The following year Dr. James F. Young joined him, and they team-taught the course through 1999, when Dr. Bennett left Rice to join the faculty at the University of Colorado. Many individuals and companies contributed to the development of this course. Fred Martin developed the widely emulated M.I.T. 6.270 IAP course patterned as a Robot Design Competition. His approach to teaching engineering design has proven so successful that his ideas have been adapted at many schools across the country. The M.I.T. Department of Electrical Engineering and Computer Science and the M.I.T. Media Laboratory, who sponsored the development of the original 6.270 class technology, have agreed to unrestricted and free distribution of the robotics technology described in the course documentation for the 6.270 class. The Department of Electrical Engineering and the George R. Brown School of Engineering at Rice University have agreed to similar unrestricted distribution of the ELEC 201 class technology developed at Rice.

References

- Rice ELEC 201** - Course web site², including course notes, which are slowly being put on Connexions.
- MIT 6.270** - Course web site³.
- Fred G. Martin** - The course notes from MIT's 6.270 were developed into the book *Robotic Explorations*, Fred G. Martin, Prentice Hall (2001) ISBN 0-13-089568-7
- Handy Board** - Web site⁴ for the controller board originally used in 6.270; an advanced version was developed at Rice for ELEC 201.

²<http://www.owl.net.rice.edu/legolab>

³<http://web.mit.edu/6.270/www/>

⁴<http://handyboard.com/>