

Spring 2008

ENME 489L: Biologically Inspired Robotics

Logistics

Class Time: Tuesday and Thursday 2PM to 3:15PM

Class Location: JMP 2202

Office Hours: Tuesday and Thursday 3:30PM to 5:00PM

Course Instructors: Satyandra K. Gupta and Arvind Ananthanarayanan

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Synopsis

Engineers have discovered that designs in natural world can be successfully exploited to create engineered artifacts. Over the last several years, engineers have come up with many new robot designs that are based on biological entities. These new designs offer significant benefits over the traditional robot designs. This course will cover the fundamentals and applications of biologically inspired robots.

Syllabus

This course will consist of the following three main parts:

- ***Fundamentals of Traditional Robotic Manipulators***: In order to conceive, analyze, and create new robot designs, one must be familiar with the fundamentals of traditional robots. This part of the course will begin with the history and taxonomy of traditional robots. Different popular robot configurations will be introduced. This part will also cover forward kinematics, inverse kinematics, and dynamics of serial manipulators to analyze proposed robot designs.
- ***Fundamentals of Biologically Inspired Robotics***: This part of the course will begin with a discussion on the role of biological inspiration in robot design. Some of the questions being explored include “What can nature offer to engineers?” and “Can biologically inspired designs outperform traditional technology?” The next topic that is discussed is how engineers can quantify and evaluate nature in order to select the animal that best meets a set of design requirements. Several examples of bio-inspired robots will be discussed in detail, including the motivation and biological inspiration for their design, as well as technical specifications and comparisons to conventional robots. The examples will include robots inspired by the cockroach, snake, and tuna.
- ***Design and Fabrication of Biologically Inspired Robots***: This part of the course will cover techniques for designing and fabricating biologically inspired robots. This part

will also cover selecting and programming micro controllers for controlling biologically inspired robots and servo motors for driving the robots. We will also describe the basics of rapid prototyping machines to create the robot structure.

Textbook

- J.J. Craig. *Introduction to Robotics: Mechanics and Control*. Prentice Hall; 3rd edition, 2003

Additional References

- G. A. Bekey. *Autonomous Robots*. MIT Press, 2005
- Karl Williams. *Amphibionics: Build Your Own Biologically Inspired Reptilian Robot*. McGraw-Hill/TAB Electronics, 2003
- David Cook. *Robot Building for Beginners*. Apress, 2002

Homeworks, Projects, and Examinations

Course grade will be based on students' performance in the following items:

- 8 Homeworks (done individually) (20% of the overall grade)
- Course Project (done in groups of 3) (40% of the overall grade)
- 1 Final Exam (40 % of the overall Grade)

Code of Academic Integrity

The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit <http://www.studenthonorcouncil.umd.edu/whatis.html>.