A. JAMES CLARK
SCHOOL OF ENGINEERING

Course: ENPM 661– Planning for Autonomous Robots

Synopsis

Planning is a fundamental capability needed to realize autonomous robots. Planning in the context of autonomous robots is carried out at multiple different levels. At the top level, task planning is performed to identify and sequence the tasks needed to meet mission requirements. At the next level, planning is performed to determine a sequence of motion goals that satisfy individual task goals and constraints. Finally, at the lowest level, trajectory planning is performed to determine actuator actions to realize the motion goals. Different algorithms are used to achieve planning at different levels. This graduate course will introduce planning techniques for realizing autonomous robots. In addition to covering traditional motion planning techniques, this course will emphasize the role of physics in the planning process. This course will also discuss how the planning component is integrated with control component. Mobile robots will be used as examples to illustrate the concepts during this course. However, techniques introduced in the course will be equally applicable to robot manipulators.

Topics

- Motion Planning in Static Environments
- Motion Planning in Dynamic Environments
- Motion Planning under Uncertainty
- Geometric Modeling and Robot Body Transformations
- Trajectory Planning under Differential Constraints
- Integration of Motion Planning with Task Planning, Behavior Execution, and Control.

References

- Steven LaValle. Planning Algorithms. Cambridge University Press. 2006. (REQUIRED).
    - This is also freely available online: http://planning.cs.uiuc.edu/
- Howie Choset, Kevin Lynch, Seth Hutchinson, George Kantor, Wolfram Burgard, Lydia Kavraki, and Sebastian Thrun. Principles of Robot Motion: Theory, Algorithms, and Implementations. MIT Press, 2005.
- Sebastian Thrun, Wolfram Burgard, and Dieter Fox. Probabilistic Robotics. MIT Press 2006.
- Roland Siegwart, Illah Nourbakhsh, and Davide Scaramuzza. Introduction to Autonomous Mobile Robots. MIT Press, 2011.

Homework, Projects, and Examinations

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

- Homework (20% of the overall grade)
- Quizzes (10% of the overall grade)

- Course Project (35% of the overall grade)
- Take Home Final Exam (35% 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.