Overview

*Marine Robotics and ROS* is a graduate level course in applied marine robotics with a strong emphasis on autonomous control of marine robots using the Robot Operating System (ROS).

*Marine Robotics:* The course will focus on applying specific Guidance, Navigation, and Control (GNC) solutions for a known platform. I.e. the robot model is assumed known and the student is expected to develop autonomous and/or semi-autonomous behaviors.

*ROS:* At its core, ROS is a publish-and-subscribe network that provides a “flexible framework for writing robot software. It is a collection of tools, libraries, and conventions that aim to simplify the task of creating complex and robust robot behavior across a wide variety of robotic platforms.” ¹ Most ROS tools libraries and add-ons are written in python, or C++, but ROS does provide APIs for other programming languages (e.g. Matlab).

This is an applied, project-based course. **You are expected to learn heuristically and to take control, as grad students should, of your learning objectives.**

Objectives

What do I want the students to be able to accomplish at the end of this course?

- **GNC**
  - Identify/Develop/Apply a global control architecture/block diagram.
  - Develop, simulate, and apply a solution for all three aspects of GNC.
    - Utilize an appropriate model to develop.
    - Tune and modify for real world application.
- **ROS**
  - Can develop a publisher, subscriber, service, action and knows when to utilize each.
- **Publication**
  - Can communicate effectively in an academic context.

¹ [http://www.ros.org/#](http://www.ros.org/#)
Required Resources:

- ROS Capable computer
  - Distribution TBD
    - ROS Kinetic, Ubuntu 18.04 (or appropriate, e.g. Mint)
    - ROS Noetic, Ubuntu 20.04 (or appropriate, e.g. Mint)
    - ROS 2 Foxy, Appropriate operating system

Assignments and Grading

Late work will not be accepted.

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<td>- Class discussions</td>
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References:

- Robotics
    - http://hades.mech.northwestern.edu/images/7/7f/MR.pdf
    - https://www.youtube.com/playlist?list=PLggLP4f-rq02vX0OQQ5vrCxbJrzmYDfx
    - https://www.youtube.com/playlist?list=PLMrJAhkIeNNR20MzVpzgfQs5srYi085m
    - https://www.youtube.com/channel/UC-45kyxsA0XwgDTuIgpa9kw/videos

- ROS
  - General
    - www.ros.org
    - Wiki.ros.org
    - http://wiki.ros.org/ROS/Tutorials
- Conventions
  - http://www.ros.org/reps/rep-0000.html
  - http://wiki.ros.org/ROS/Patterns/Conventions#Naming_ROS_Resources

- Style guides
  - http://wiki.ros.org/StyleGuide
  - http://wiki.ros.org/PyStyleGuide
  - https://github.com/leggedrobotics/styleguide

- Best Practices
  - Never edit files in /opt/ros/…
  - http://wiki.ros.org/ROS/Patterns
  - https://github.com/leggedrobotics/rosgpio/wiki