Syllabus

ME 696	Instructor:	A Zachary Trimble, Ph.D.
Marine Robotics and ROS	E-Mail:	atrimble@hawaii.edu
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Location: HH 242	Office Hours:	Appt.

Overview

Marine Robotics and ROS is a graduate level course in applied mobile robotics with a strong emphasis on 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/#

Required Resources:

- ROS Capable computer
    - Distribution:
        - ROS 2 Humble Hawksbill

Assignments and Grading

Late work will not be accepted.

Participation - Class discussions - Quizzes - Assignments - Tutorials	15%
Project 1	20%
Project 2	25%
Project 3	40%

References:

- Robotics
    - Fossen, T. I. (2011). *Handbook of marine craft hydrodynamics and motion control*. John Wiley & Sons.
    - Lynch, K. M., & Park, F. C. (2017). *Modern robotics*. Cambridge University Press.
        - http://hades.mech.northwestern.edu/images/7/7f/MR.pdf
        - https://www.youtube.com/playlist?list=PLggLP4f-rq02vX0OQQ5vrCxbJrzamYDfx
    - Brunton, S. (2021). *Control Bootcamp.* YouTube.
        - https://www.youtube.com/playlist?list=PLMrJAkhIeNNR20Mz-VpzgfQs5zrYi085m
    - Penn Engineering. (2020-2017). *R Shoots YouTube Channel*. YouTube.
        - https://www.youtube.com/channel/UC-45kyxsA0XwgDTuIgpa9kw/videos
- ROS
    - General
        - https://www.openrobotics.org/
        - www.ros.org
        - http://docs.ros.org/en/humble/
        - https://navigation.ros.org/
        - https://moveit.ros.org/

- Conventions
  - http://www.ros.org/reps/rep-0000.html
  - http://wiki.ros.org/ROS/Patterns/Conventions
- Style guides
  - http://wiki.ros.org/StyleGuide
  - http://wiki.ros.org/DevelopersGuide
  - http://wiki.ros.org/CppStyleGuide
  - http://wiki.ros.org/PyStyleGuide
  - http://www.ros.org/reps/rep-0008.html
- Best Practices
  - Never edit files in /opt/ros/…
  - http://wiki.ros.org/ROS/Patterns
  - https://github.com/leggedrobotics/ros_best_practices/wiki