

Course: EW456 Autonomous Vehicles

Credits: 3 credit – 2 recitation hours – 2 laboratory hours

Course Description: Advanced topics in dynamics, control and estimation as they apply to unmanned vehicles. Introduction to specifics of aerial and/or ground vehicles. Laboratory exposure to navigation hardware and an open ended project.

Pre-requisites: 1/C ERC or ERCH major

Course Coordinator: Prof Piper

Textbook: None

Course Objectives:

This course investigates advanced topics in dynamics, navigation and control associated with unmanned vehicles. Upon completion of this course students will attain experience and proficiency with:

- (a) Coordinate systems and transformations
- (b) Vehicle dynamics
- (c) Common navigation and control sensors
- (d) Filtering

Students will gain insight into the characteristics of ground and/or air vehicles through end of semester project

Topics:

Lectures

- Intro
- Vehicle Kinematics
 - Coordinate Systems
 - Transformations
 - Orientation representation
 - Euler Angles
 - Quaternions
 - Angular rates
 - Body rates
 - Euler rates
 - Velocity of a point
 - Acceleration of a point
- Vehicle Sensors
 - IMU Principles
 - IMU Technology
 - Magnetic Sensors
 - Optical Flow
 - Filtering & Estimation
- Vehicle Dynamics
 - Rigid Body Dynamics
 - Translation
 - Rotation
 - Simulation

Linearized Model

State Space

Transfer Function

- Vehicle Control
 - Quadrotor Dynamics
 - Control Architecture
 - Control Loop Design

Labs

- Euler Angle Lab
- IMU Lab
- Compass Lab
- Estimation Filtering Lab
- Vehicle Dynamic Simulation Lab
- Quadrotor Control Lab
- MiniDrone Control Project

Last Updated: 17-December-2020

