

Course Number and Title

ORE 791 Special Topics in ORE (Autonomous Marine Systems)

2. Credits and Contact hours

Two 1.25-hour sessions per week. Course is 3 credits.

3. Instructor

Michael Krieg

4. Textbooks

Textbook: None

a. Other Supplemental Materials

- i. Antonelli, G., Underwater Robots, Springer Int. Publishing, 2014
- ii. Fossen T.I., Handbook of Marine Craft Hydrodynamics and Motion Control, John Wiley & Sons, 2011.

5. Course Information

- a. Course Content: Analytical techniques crucial for the design and operation of robotic marine vehicles. Coordinate transformations and force allocation, hydrodynamic modeling of vehicle bodies and propellers, and introduction of automated control methodologies commonly employed on autonomous surface and underwater vehicles.
- b. Prerequisites
 - i. Linear Algebra and Diff. Eq.
 - ii. Dynamics
 - iii. Basic Programming
- c. Designation: Elective

6. Course Goals

- a. Outcomes of Instruction
 - i. Understand the nature of forces acting on mobile marine platforms and learn how to model their dynamic behavior.
 - ii. Understand how to allocate control forces from measurement of tracking error and learn the basics of controller stability.
 - iii. Learn how to simulate complex vehicle systems under autonomous control

7. Topics Covered

- a. Coordinate Transformations/Rotations and Forces in Non-Inertial Reference Frames
- b. Vehicle Body Hydrodynamic Modeling
- c. Feedback Control and State Space Representation
- d. LTI Representation and System Stability
- e. Propeller Theory
- f. Jet Propulsion
- g. Subsystem Integration
- h. Classes of Marine Vehicles and Their Dynamics
- i. Numerical Simulation of Complex Dynamical Systems
- j. Path Planning
- k. 3D Path Following for Underactuated Systems
- l. Model Based Controllers
- m. Adaptive Controllers