Chapter 9: Control and Navigation

Stories From Real Life: Human Torpedoes and Midget Subs

Chapter Outline

1. Introduction
2. Control Systems
   2.1. Open-Loop Versus Closed-Loop Control
   2.2. The Human Role in Vehicle Control Systems
3. Navigation
   3.1. Specifying Position or Location
   3.2. Navigational Instruments
4. A Basic Control and Navigation System
   4.1. An Overview of Electric Switches
   4.2. Using a Manual SPST Switch to Turn a Light ON or OFF
   4.3. Using a Manual DPDT Switch to Control Motor Direction
   4.4. Limitations of Manual Switch Control
   4.5. Adding a Basic Set of Navigational Sensors
5. Advanced Control Options: Moving Beyond SeaMATE
   5.1. Do You Really Need Advanced Control?
   5.2. A Peek at the Possibilities
5.3. Microcontrollers
5.4. An Introduction to Electronic Signals and Communication
5.5. Analog Data Transmission
5.6. Digital Data Formats
5.7. Digital Data Transmission
5.8. Analog-to-Digital Conversion
5.9. Signal Multiplexing
5.10. Electronic Sensors and Sensor Circuits
5.11. Data Display Options
5.12. Using Transistors and Relays for Automated Power Control
5.13. Motor Controllers
5.14. Limiting Motor Travel
5.15. Feedback Control Algorithms
6. Chapter Summary

Chapter Learning Outcomes

- Give examples of control systems used in ROVs and AUVs. Discuss the advantages and disadvantages of open-loop versus closed-loop control and of simple versus complicated control systems.
- Explain the purpose and function of the navigational instruments and motor control switches used on a simple ROV like SeaMATE.
- Explain what a microcontroller is and what role it can play in the control systems used for ROVs or AUVs.
- Explain how a microcontroller can get commands from a pilot through buttons, knobs, and joysticks or from various navigational sensors.
- Explain how a microcontroller can operate thruster motors, video lights, gripper arms, and other systems on a vehicle.
- Give examples of common control algorithms; list some possible causes and solutions for common control system malfunctions.