Creating a practical lab to study first-order and second-order systems using MATLAB and Simulink is a great way to gain hands-on experience with control systems. Here's an example of a lab experiment that covers both types of systems:

Lab Title: Introduction to First-Order and Second-Order Systems

Objective: To understand and experimentally study the behavior of first-order and second-order control systems using MATLAB and Simulink.

Equipment Needed:
1. MATLAB software with Simulink.
2. Computer with the necessary hardware and software.

Experimental Setup:

Part 1: First-Order System

1. **Modeling a First-Order System:**
   - In MATLAB/Simulink, create a new model.
   - Add a Step Input block to the model to represent the system's input.
   - Add a First-Order Transfer Function block to represent a first-order system. Configure the transfer function with a time constant and gain.
   - Connect the input to the transfer function and add a Scope block to visualize the system's response.

2. **Experimental Steps:**
   - Run the simulation and observe the response of the first-order system to a step input.
   - Experiment with different time constants and gains in the transfer function to understand how they affect the system's response.

Part 2: Second-Order System

1. **Modeling a Second-Order System:**
   - Create a new model in MATLAB/Simulink for the second-order system.
   - Add a Step Input block for the input signal.
   - Include a Second-Order Transfer Function block to represent a second-order system. Configure the transfer function with natural frequency and damping ratio.
   - Connect the input to the transfer function and add a Scope block to visualize the system's response.

2. **Experimental Steps:**
   - Run the simulation and observe the response of the second-order system to a step input.
   - Experiment with different natural frequencies and damping ratios to understand their impact on the system's behavior.
   - Compare and contrast the responses of first-order and second-order systems.

Data Collection:

1. Record the time response of both the first-order and second-order systems for various parameter values.
2. Document the settling time, rise time, overshoot, and other relevant response characteristics.

Analysis:

1. Analyze the data and plot the responses of first-order and second-order systems.
2. Discuss how changing system parameters affects the behavior of each type of system.

Conclusion:

Summarize the key findings and insights from the lab, including the differences between first-order and second-order systems, and how system parameters influence their responses.

Discussion:

Engage in a discussion about real-world applications of first-order and second-order systems, such as RC circuits, mechanical systems, and control systems, and how this knowledge can be applied in engineering and control theory.

This practical lab provides hands-on experience in modeling, simulating, and analyzing the behavior of first-order and second-order systems, which are fundamental concepts in control theory and engineering.