MATLAB is a powerful tool to solve complex differential equations and do near-instant parallel calculations for simulations. In this lab we learned and reviewed the functionality of simulating a mass spring system through a system of ODE’s, the state space method, and finding a transfer function for the system. We then apply what we use in these problems to simulate an inverted pendulum-cart system. To simulate the pole-cart system we implemented the equations of motion in the state space form, assuming various parameters like weight of the cart and length of the pendulum and using a piecewise function to apply an external force to the cart. The straightforward state-space matrices and the lsim() function make simulating the pole-cart system simple, which allows us to understand how to get the state space equations and external functions in the first place.