

Interactive Session 14

ESC 202 - Dynamics

Not graded, completed in class on February 28, 2025

Note that these problems are all a little harder than MH3. For these problems, you will use Euler integration from MH2. For MH3, there is a constant velocity and a known displacement, so you should just loop over different increments of position, not loop over time like these problems ask you to do.

1 Work of Drag on a Bowling Ball

Find the work that drag does on 10 lb bowling ball with a diameter of 8.5 inches when dropped from a height of 100 feet. Recall that the force of drag acting on this bowling ball at any instant can be determined by

$$F_D = 0.018 * A * v^2$$

2 Work of a Toy Rocket

The force of thrust from a toy rocket can be simplified as

$$F_T = v_e \dot{m} + 25$$
$$\dot{m} = 2e^{-t/5}$$

where F_T is the force in Newtons from the liquid rocket engine and \dot{m} is the mass flow rate of the combusted liquid fuel, while v_e is the exit velocity of the combusted fuel. Assuming a constant v_e of 100 m/s , find the work a rocket engine does on a 5 kg rocket in the first 10 seconds of flight, if it starts with 2 kg of fuel. The rocket flies up and gravity is $-9.81 m/s^2$. Display your answer to the command window using “fprintf” or “disp.”

3 Power of Toy Rocket Engine

Plot the power vs time curve of the situation above.