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Phase 2
MEEN 357-505 Team 14
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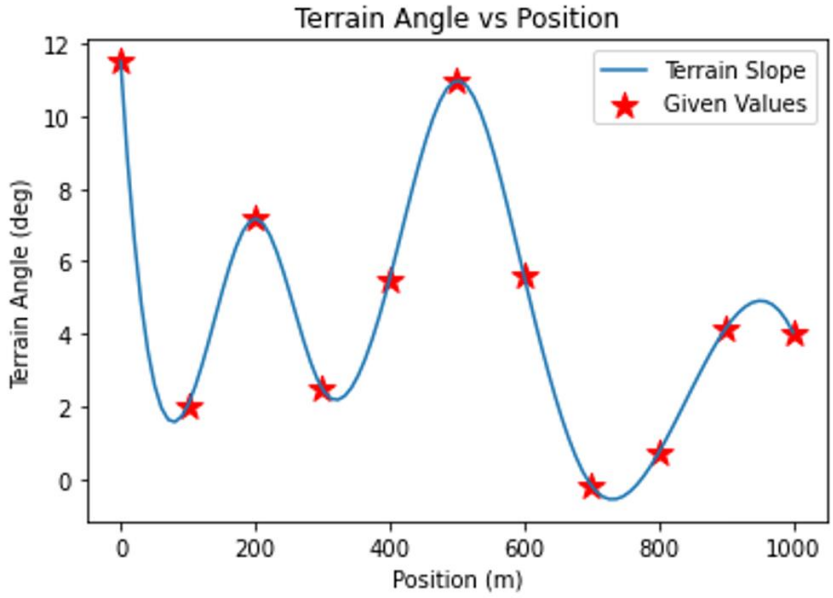
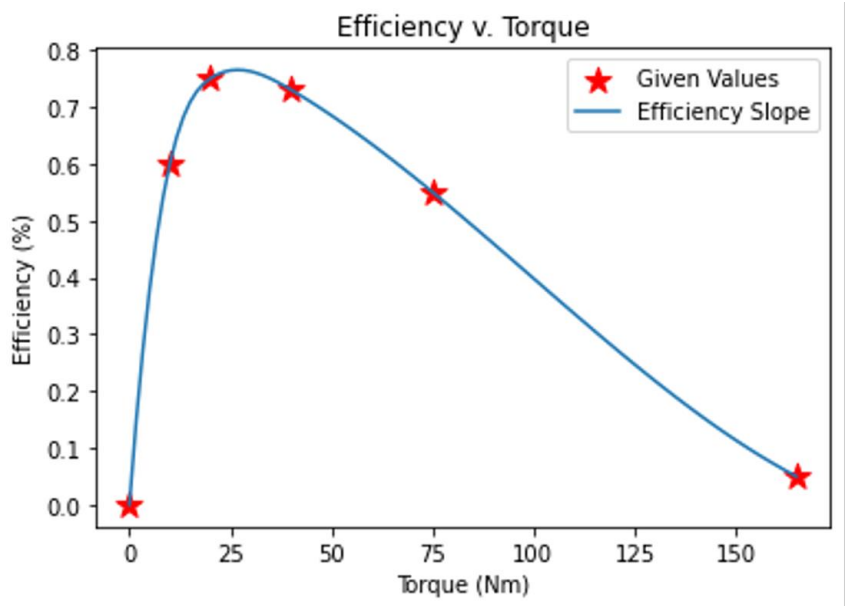
Task 2:



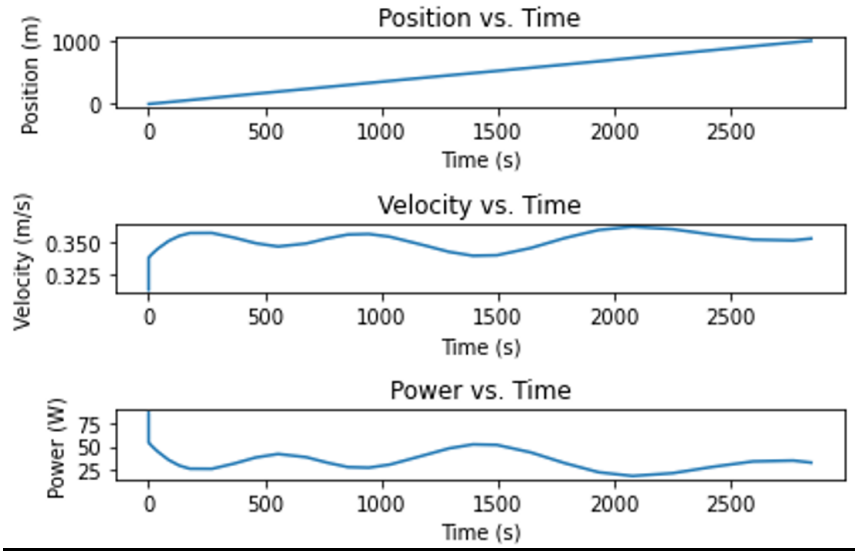
This task compares the position of the rover in meters to the terrain angle in degrees. Using scipy.interpolate to interpolate between the values in define_experiment, we are able to procure a graph with specific terrain angle values incrementing by 100 m from 0 to 1000 m. As the terrain angle increases, the rover's speed will decrease, and as the angle decreases, the rover's speed will increase. This makes sense given the graph and understanding that the angle will change depending on the location of the rover.

Task 5:



Rover can be redefined using any given dictionary of values that are within the range defined in the code. This way, different sets of rover data can be tested using the same code as long as the required values are appropriately defined and the data set is defined as rover. Using the scipy.interpolate function once again to interpolate between the data set in the rover dictionary, we generated a graph that depicts efficiency vs. torque. This graph depicts the exponential efficiency increase until about 25 Nm, then a steady decrease to almost 0% over an interval of about 145 Nm. Furthermore, the rover experiences around 75% efficiency at its peak, which makes sense because no real-life system is able to be 100% efficient unless it exists under perfect physics conditions.

Task 8:



Completion Time (s)	2842.731
Distance Traveled (m)	1000.0
Maximum Velocity (m/s)	0.361814
Average Velocity (m/s)	0.341083
Battery Energy (J)	997735.346
Battery Energy per Distance (J/m)	997.735

Knowing the bumpy terrain of mars with differing angles, the graphs of the rover's position, velocity, and power vs. time make sense. Beginning with position vs. time, the linear slope of the graph is expected because distance is constantly being traveled and gained, thus it increases linearly with time. For the velocity vs, time graph, velocity increases or decreases with respect the terrain slope or angle depicted in task 2. The more rocky or bumpy areas will cause a decrease in velocity as displacement becomes smaller, while the smoother parts of Mars's surface will yield an increasing velocity. This is accurately represented by the sinusoidal motion of the curve in the graph. Lastly, having the rover cross more difficult or steeper terrain directly correlates to using more power to push the rover forward to overcome any obstacles. In other words, an increase in slope leads to larger power usage to maintain a consistent

velocity. This is why the graphs of velocity vs. time and power vs. time seem to be inverted– because terrain angle and velocity are inversely proportional while terrain angle and power are directly proportional.

Task 9:

If the energy of the battery minus the energy required, battenergy in the code, is positive, then the battery has enough energy to complete the case. The battenergy value as solved for in experiment1 is 997735.346 J. The energy of the Lithium Iron Phosphate battery is 907200 J. 907200 - 997735.346 equals -90535.346 J, which means that the battery will not be able to support the energy required and the case defined in experiment1 will not be completed.