Colorado State University

"Midterm Project"

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As a midterm project, we will integrate the laboratory and lecture portions of the course. For this project I expect you to demonstrate your capability to accomplish the following:

1. **Establish Purpose and Scope (5pts)**

Describe the background and scope of your project. Describe and document your simulation's purpose and scope.

2. **Perform Validation Procedures Including Uncertainty Quantification (20pts)**

You will have to calculate the uncertainty in your model of walking velocity using data that you gather from subjects on earth. Measure multiple subjects' leg length, velocity at the walking/running transition, and use acceleration due to gravity g_{earth}=9.80665 m/s^2. I would like for the output of this section to present 1) your estimated error in the walking model (how much relative error does your model have in calculating the mean speed at which walk/run transition occurs in experiment?), and 2) a measured uncertainty in the experiment (a pure error estimate). These should both be calculated on the basis of documented/presented experimental data.

3. **Perform Simulation Inclusive of Uncertainty (20pts)**

Perform Kline-McClintock Uncertainty propagation (see handout) and Monte Carlo Uncertainty propagation (see previous HWs) on your simulation of walking on Mars considering uncertainty in your simulation (from above) and uncertainty in the leg length of the astronaut population of Mars (measure ~10 of your most "astronaut-likely friends'" leg lengths). Assume that the relative uncertainty in the simulation is unchanged between Earth and Mars. Calculate and characterize the distribution of the speed that a population of astronauts can walk on Mars at the most energetically efficient pace (defined as Fr = 0.25).

4. **Conclusions (15pts)**

On the basis of your results, provide a graphical and textual summary of the findings, results and recommendations. Draw some conclusions about the role of the tools that we have developed in providing decision support for this example problem.

Also, provide me with some critique or suggestions for the midterm project. What parts of the exercise surprised you (positive or negative), and how do you evaluate your simulation's accuracy and usefulness. I will evaluate this section based on the type of learning that that you demonstrate on the basis of Bloom's Taxonomy (link).

Turn in this HW on 3/25/20 at 4:59pm to Canvas. Fully document your solution, simulation, and results in <10 pages of text and figures. All problem statements must be

copied to the solutions. All diagrams and plots must be labeled with units and symbols, and must be captioned.