

These files consist of experimental data, videos from particle drop experiments, videos from particle travel distance experiments, audio files demonstrating differences in friction regime for particle motion downslope, and MATLAB code to generate Lomax random numbers and maximum likelihood estimates.

We conducted two sets of experiments. The first set was aimed at demonstrating the basis for treating the proportion of energy extraction,  $\beta_x$ , as a random variable. The experiments involved dropping the particles onto a smooth rigid surface of slate, and onto a rough surface. We recorded particle motions using a Lightning RDT monochrome camera (DRS Technologies) operating at 800 frames per second. The camera was mounted on a tripod, and oriented parallel to the horizontal surface. The image resolution was  $1,280 \times 640$  pixels.

Files pertaining to the first set of experiments include:

1. Angular\_all\_rotational.avi
2. Angular\_collinear.avi
3. Angular\_rotation\_to\_vertical.avi
4. Rounded\_collinear.avi
5. Semiangular\_rotational\_die.avi
6. smooth\_calculations.xlsx
7. smooth\_marbles.xlsx
8. rough\_calculations.xlsx
9. rough\_marbles.xlsx

In the second set of experiments we launched particles of varying size and angularity onto the rough surface, then 60 measured their travel distances for several slope angles. We recorded motions of particles launched from the catapult onto the rough surface with high-speed imaging at a resolution of  $640 \times 640$  pixels. In addition we made audio recordings of particle-surface interactions during their downslope motions. Audio recordings were made and processed using the Garage Band application on a 6th generation Apple iPad.

Files pertaining to the second set of experiments include:

1. Angular\_18%slope.avi
2. Angular\_28%slope.avi
3. Rounded\_0slope.avi
4. Bouncing.m4a
5. Sliding.m4a
6. Rounded.xlsx
7. Angular.xlsx
8. Small.xlsx
9. Lomax\_Random\_Number.m