Analyzing Viscoelastic Force-Displacement Curves

Viscoelastic materials exhibit hysteresis during loading and unloading, and force-displacement curves are often generated during mechanical testing to characterize the properties of a viscoelastic system (e.g. a vehicle tire). Viscoelastic systems are often used as components in a larger system, and the performance of the larger system is often highly dependent on the properties of its viscoelastic components (e.g. a vehicle’s performance is dependent on the properties of its tires).

For this workshop, we will provide a set of data files containing force and displacement data from a variety of different viscoelastic systems. The objective will be to calculate features from the data sets that effectively describe the variability between the different viscoelastic systems. Some features will be trivial to calculate (max force, max displacement, time to peak force, etc.) while others will be more complicated. For example, what metrics can be used to describe the shape of curve or the nonlinearity in the system?

As the feature set increases, other problems will emerge. Should dimensionality reduction methods be employed? Do certain clusters emerge from the data set? What is the best way to visualize the data for a technical audience? What is the best way to visualize the data for a non-technical audience?

