Overview
Kern-Liebers manufactures springs and complex strip and wire parts. One such spring is utilized in the power liftgate system typically seen in passenger vehicles. This is the part that automatically opens the hatchback of the vehicle. Kern-Liebers requested a static and dynamic analysis of the stress state of the spring for various angles of the hatchback.

Objectives

Approach
We did not need to narrow our possibilities for our design method as Kern-Liebers requested the analysis be done in Excel. The static analysis was completed using the spring design method learned in ME 360 Machine Design including a quick fatigue analysis for infinite life. Should the spring fail for infinite fatigue, Kern-Liebers may reference an S/N diagram with the calculated values to estimate the lifespan of the spring. Any of the input values can be changed and the spreadsheet will update automatically. The dynamic model was done using the state-space method learned in ME 450 Modelling of Dynamic Systems.

Outcomes

- The spreadsheet allows Kern-Liebers to rapidly design a spring for use in a powered liftgate by calculating factors of safety against yielding and infinite fatigue life
- S/N curves for common spring materials are not included with the spreadsheet and must be referenced by Kern-Liebers
- The dynamic model can be altered for any input velocity profile, damping, mass, and spring constant to calculate the time-response of the maximum shear stress in the spring