PennState
College of Engineering

ME 563: Non-linear Finite Elements in Engineering

Application of the Finite Element Method to Real World Problems

Truck Crash

The purpose of this application is to further demonstrate production-level finite element modeling.

When you complete this application, you will be able to:

- Explore parametric studies of impact speed.
- Post-process the results and animate its modes of deformation.

1. Setting up the model

Clone the repo from github:
git clone https://github.com/rhk12/truck

There will be three sub-directories: v1, v2, and v3.

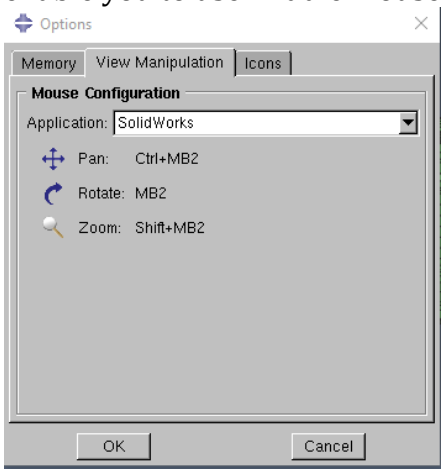
Open the Abaqus database file truck_v4_vX.cae located on Canvas, where X is 1, 2, or 3.

Note, I have supplied an abaqus teaching license in the same directory. Depending on ACI Roar, this may not work. If it gives problems, just remove, or rename the file. For example,
> mv abaqus_v6.env abaqus_v6.env.bk

The three directories **v1**, **v2** and **v3** are for three different impact velocities.

If it asked you to convert the database, go ahead and accept this.

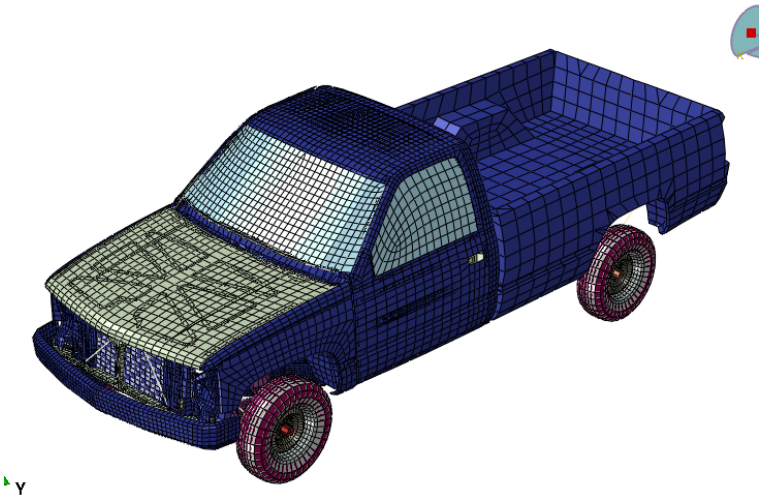
Adjust view manipulation: Tools-> Options->View Manipulation. Select SolidWorks. This will enable you to use middle mouse button to rotate.



Inspect:

- Three parts

- Extensive materials
- Color by materials:



- Use display groups to highlight different sets.

2. Checking the Boundary Conditions

Navigate to v1 and open abaqus cae. Go into Load module and explore boundary conditions. Note units are in mm, kg, s.

See IC-1 which is the initial velocity = 15,111 mm/s

Also see IC-2 is tire pressure!

Write Input file and submit a slurm jobs submission (there should be one in each directory). Note job name is Job-1.inp in the slurm file. Also note I have see some issues where the teaching license causes the slurm job to fail. If this happens, please let me know and also just remove the teaching license and then resubmit.

Now navigate to v2 and see how the initial velocity has changed to 25111.1 mm/s. Note that when you write the input file from the job module, you need to ensure that v2 is set as the working directory. To do this go to: File-> Set Working Directory.

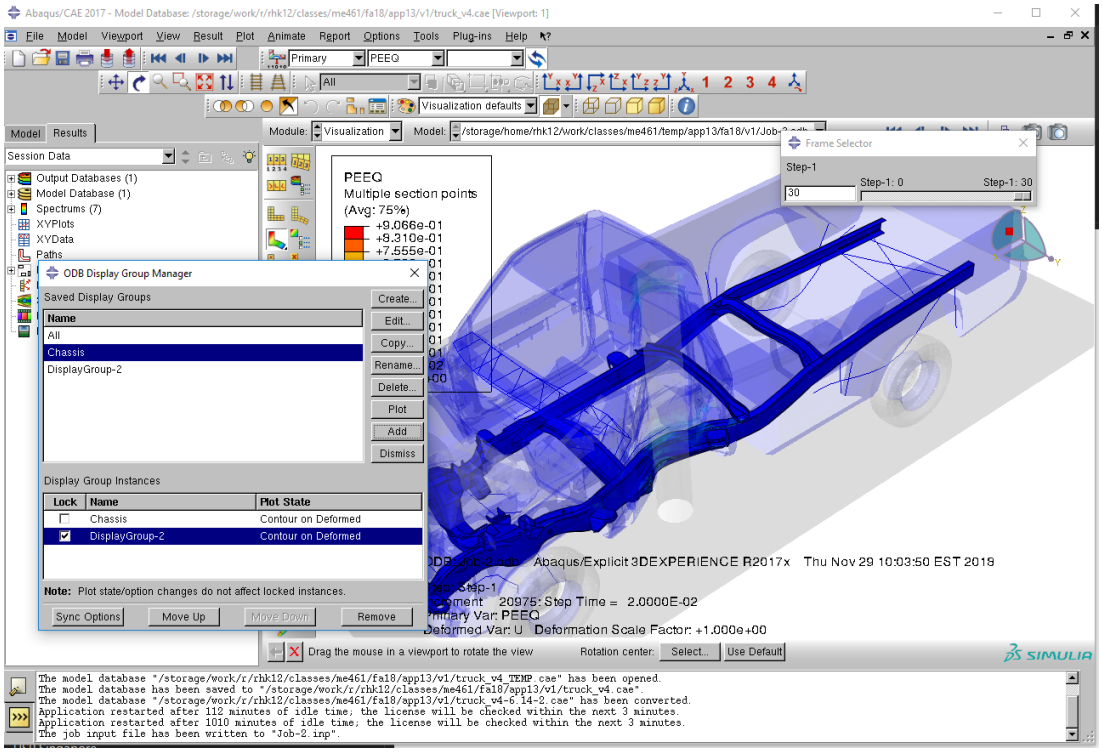
Complete this process for v3 as well. V3 = 35,111 mm/s.

3. Run the simulations

Navigate to each subdirectory and submit a job using sbatch. Continue to monitor your jobs.

4. Explore the results

Explore options with display groups and overlay plots.



Create display group of just Chassis

Create display group of everything but exclude chassis. Call it DG2

Show DG2 and turn on transparency from common options, then lock the display using display group manager. Shown above.

Then add the Chassis to the plot.