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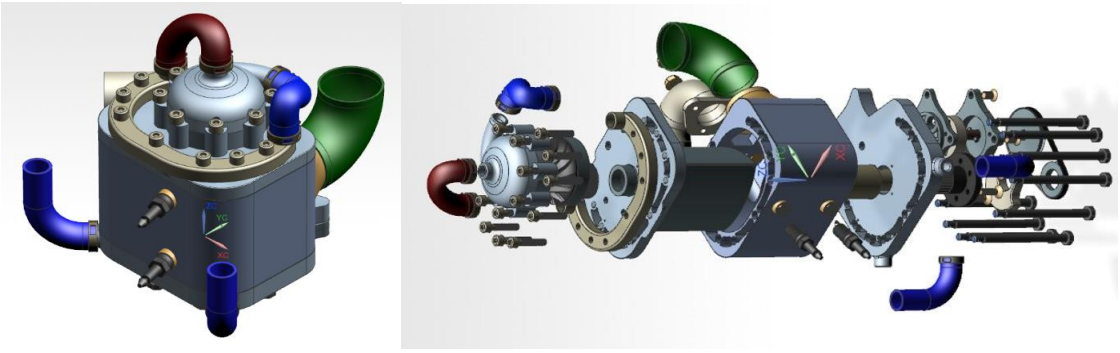
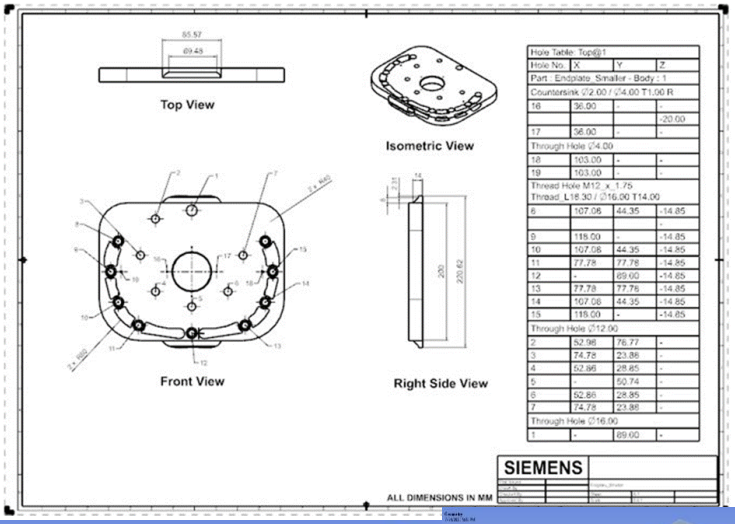
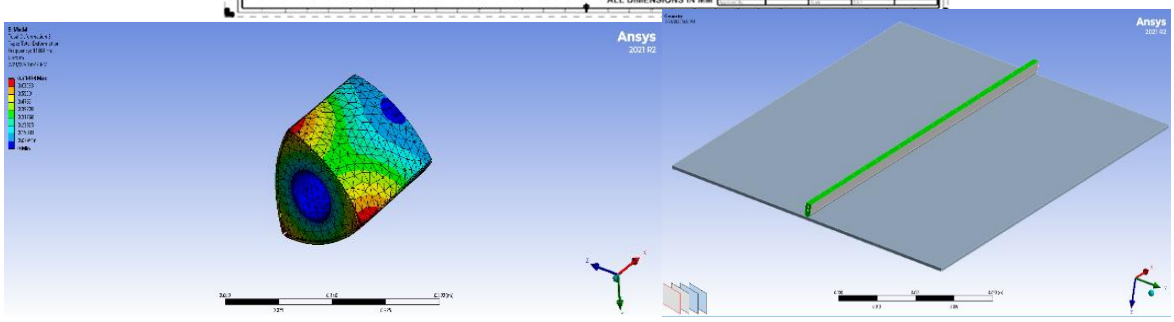
Design and Optimization of Hydrogen Rotary Engine (Siemens NX and ANSYS)



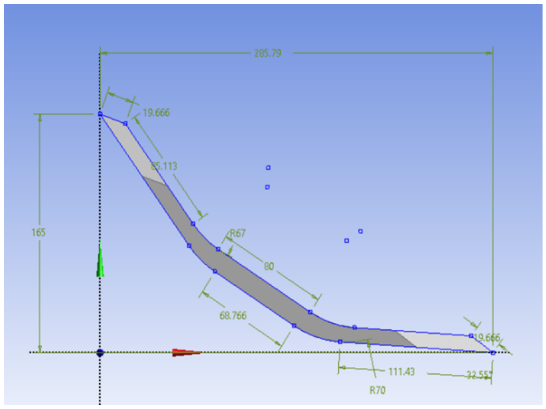
The Rotary Engine uses an internal combustion engine that uses an eccentric rotary design. The project consists of a total of 103 components (46 unique). The objective of this project is to reduce the stresses experienced by the apex seal (maintains gas tight seal).

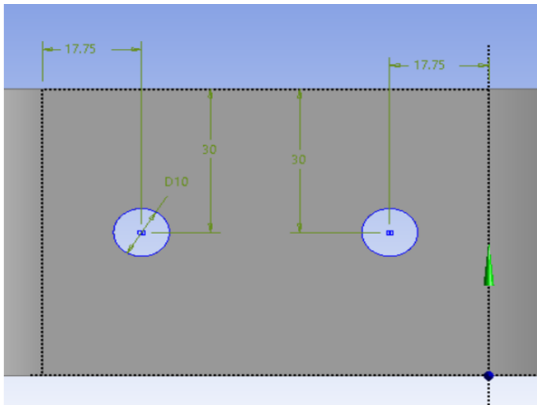




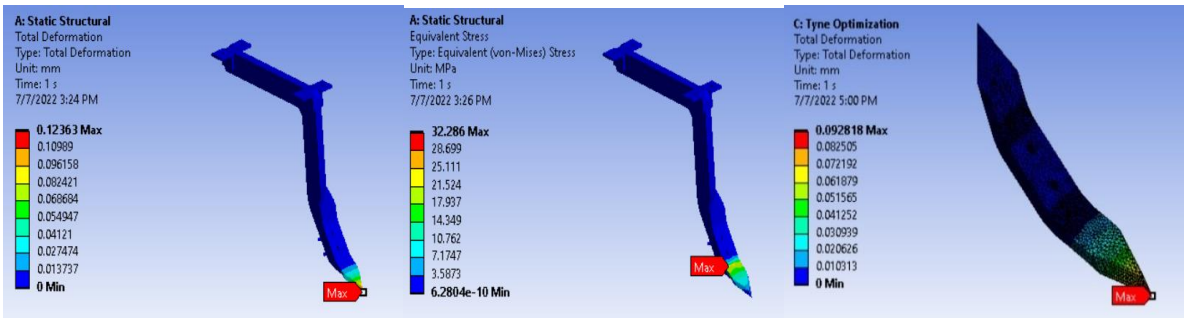
- The apex seal was modified by introducing a cross hollow pattern to reduce the overall friction forces experienced by the seal.
- A static structural, fatigue test was carried out for the seal and a modal analysis for reuleaux triangle shaped rotor.
- The redesigned apex seal reduced the equivalent stress by 17% and the deformation by 21%.

Finite Element Analysis and Optimization of Agricultural Tyne Blade (Catia V5 and ANSYS)





The Cultivator blade, which is part of a larger assembly, consists of 2 holes. The objective of this study is to identify the best material and the optimum distance between the holes, fillets, diameter etc., for least equivalent stress.



The Agricultural Cultivator Blade was modified/redesigned in CATIA V5, and a Static Structural Analysis and Optimization was performed using ANSYS.

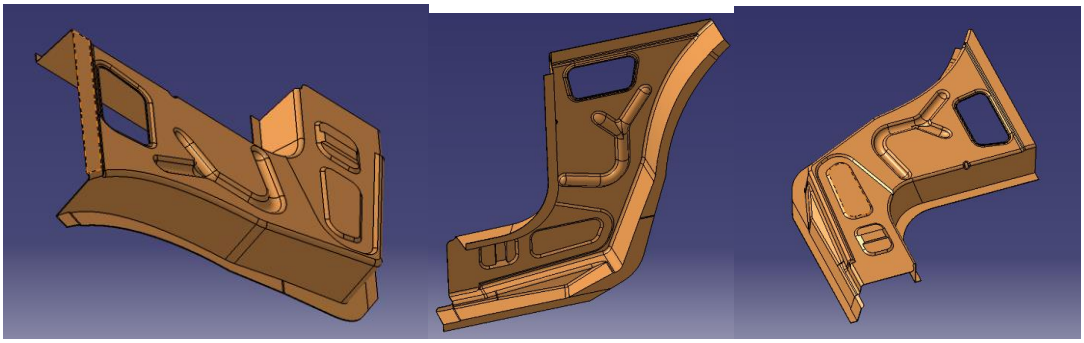
Table of Schematic D4: Optimization , Candidate Points

	A	B	C	D	E	F	G	H	I	J
1	Reference	Name	P1 - Hole1dist (mm)	P2 - Hole2dist (mm)	P6 - TotHlength (mm)	P7 - InnerFillet (mm)	P4 - Equivalent Stress Maximum (MPa)		P5 - Total Deformation Maximum (mm)	
2							Parameter Value	Variation from Reference	Parameter Value	Variation from Reference
3		Candidate Point 1	17.504	20	285.79	64	14.87	0.00%	0.11383	0.00%
4		Candidate Point 2	15.628	18.713	285.57	64.006	14.899	0.19%	0.11456	0.64%
5		Candidate Point 3	17.503	15.93	285.1	64.021	14.904	0.22%	0.117	2.79%

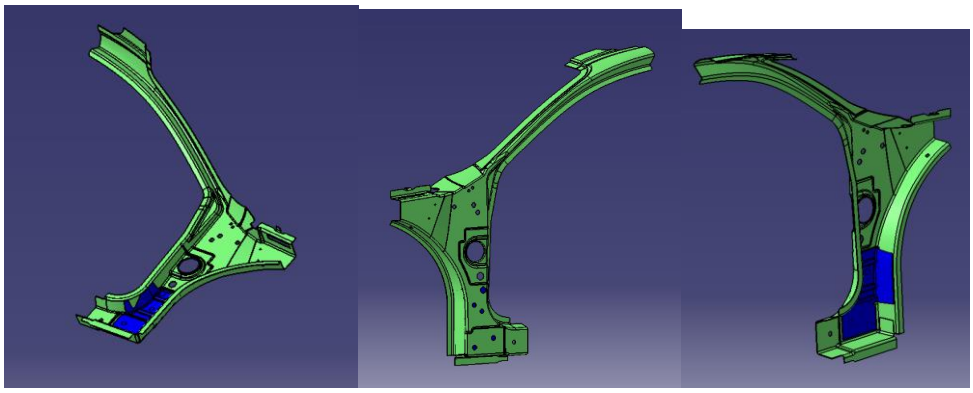
- Mild Steel was chosen as the material for the cultivator blade due to a lower max stress smaller deformation value (3.4 % lower stress and 4.93 % lower deformation than structural steel.
- The max Equivalent stress experienced by the blade was reduced by 0.45%

Body in White (BIW) Design and Reverse Engineering using CATIA V5

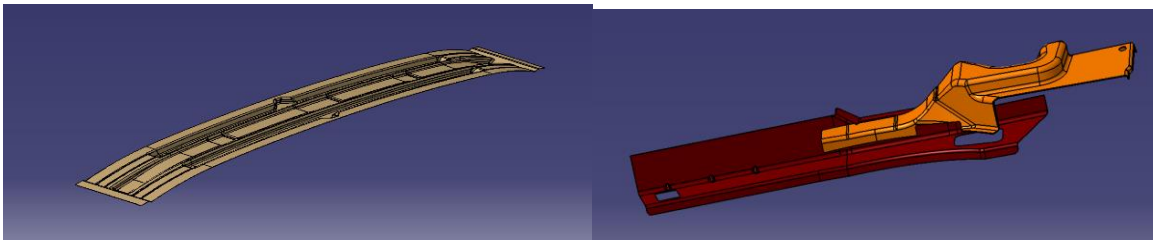
1) Car Door Panel



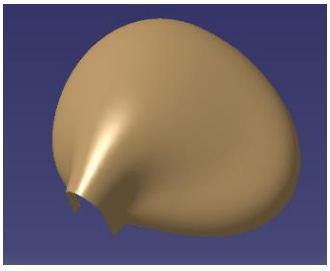
2) **Door Hinge Assembly**



3) **Miscellaneous**

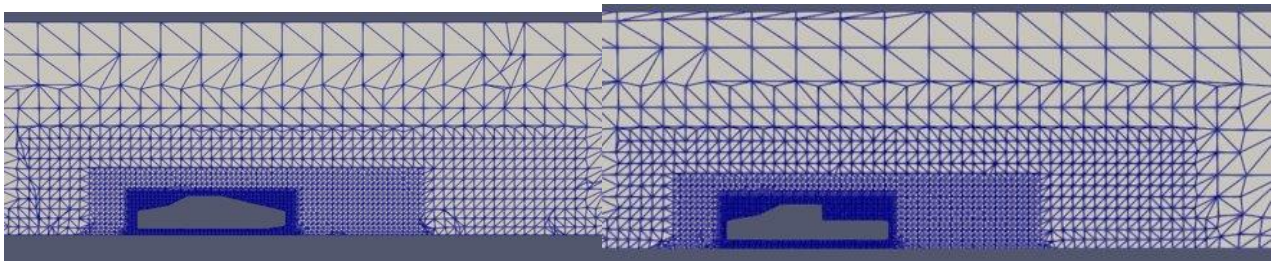


4) **Reverse Engineering – Car Mirror**

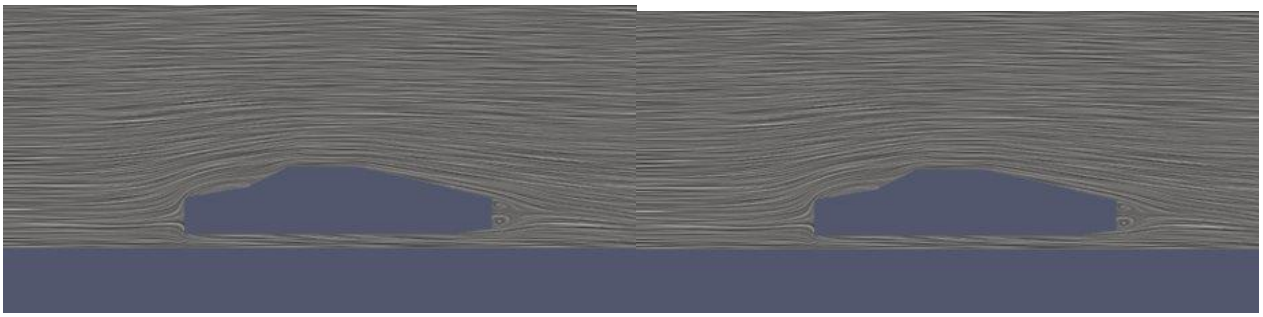


Aerodynamic Analysis and modification of Pickup truck using OpenFOAM

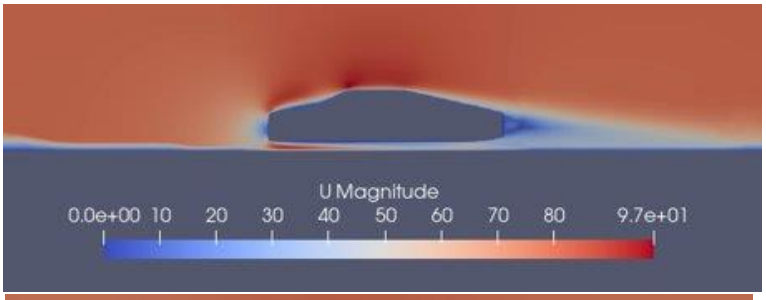
- The objective of this project is the reduction of the drag coefficient of a regular pickup truck.
- An aerodynamic cover was added over the truck bed to reduce the drag coefficient.

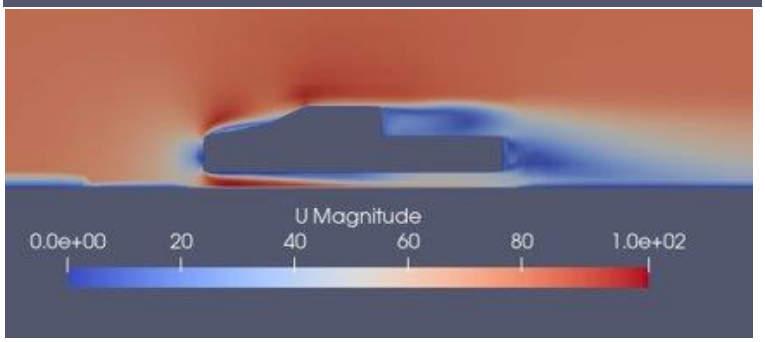


- The mesh consists of 3 bounding boxes (341399 cells and 344359 cells respectively)



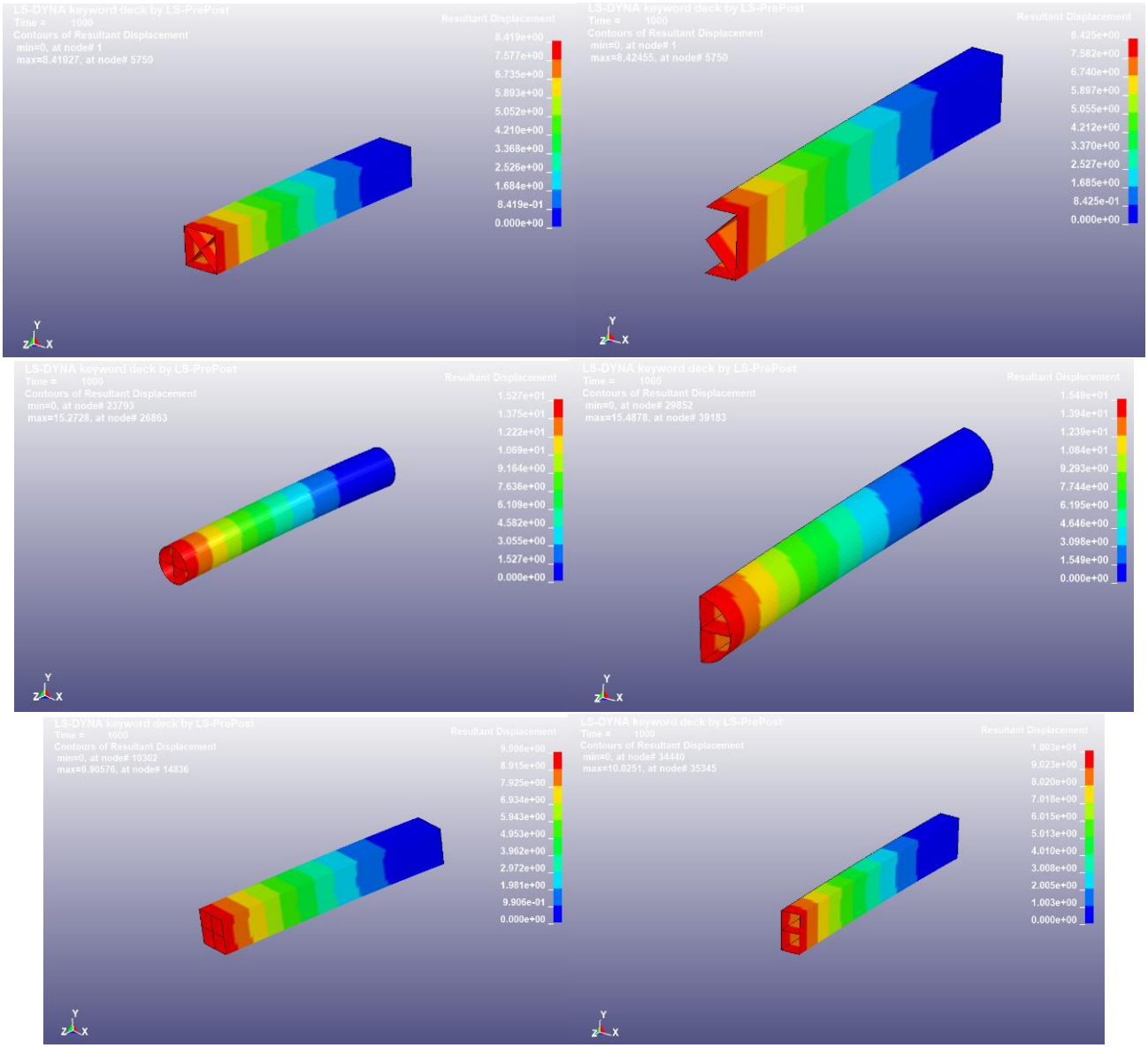
- The addition of the aerodynamic cover reduced the Drag Coefficient of the truck was reduced by 13.66%.
- The negative value of pressure over the truck bed was 2.4 times the value of the negative pressure over the aerodynamic cover.





Cantilever Bending of Full and Half Symmetry Models (LS DYNA)

The multi celled elements subjected to cantilever bending (20 kN) were modelled using both full and half symmetry models and the results were compared with the theoretical values.



- The Cumulative error for the full-scale models were 0.0577 and 0.0299 respectively.
- The Cumulative error for the half-scale models were 0.0584 and 0.0444 respectively (well within acceptable values) indicating a high-level of accuracy.
- The runtime for the full-scale model was 2.404 times the runtime for the half-scale model.

Multi Axis machining (Fusion 360)

The CAM model for the workpiece shown below is created with multi axis toolpaths. The file uses several setups to machine the parts (stock prep, soft jaw setup 1, soft jaw setup 2, multi axis setup 1, and multi axis setup 2).