About the Client

The client is one of the leading automotive OEMs in North Americas, with several models under its banner.

The Challenge

The client contacted DEP to minimize the mass model of an SUV, using gauge and shape parameterization, while maintaining performance targets. In addition, they wanted the optimized CAD model to be given to their design teams.

The Solution

The key approach involved DOE based Multi-Disciplinary Optimization and CAD morphing using DEP MeshWorks. The main steps were:

- CAE Model Built-Baseline study-Load Cases verifications for Various Disciplinary
- Parameter-Variable range as per the design feasibility considering all the architecture points
- Shape and Gauge Parameterization of the baseline CAE model in DEP Meshwork's
- DOE based design Generation and Load case application for Variable Disciplinary
- Results Interpretation-Response surface Method
- Optimization Study.
- Verification of the optimized design
- Applying Parametric Attributes into CAD-Using DEP CAD-Morpher and generating the optimized CAD (Output)

Full Vehicle Mass Optimization of an SUV

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The performance constraints were:

- **Torsional stiffness** should meet the target of 20kN-m/Deg.
- **Bending stiffness** should meet the target of 20kN/mm.
- **Torsion Mode** should meet the target of 40Hz.
- **Bending Mode** should meet the target of 50Hz.
- **Local Stiffness** should not be less than the Baseline performance.
- **Stress** of the major components should not be less than the Yield stress of the Material.

The DEP Edge

- Using the minimalistic approach by DEP, resulted in 60% time savings compared to the DoE approach.
- Using MeshWorks for de-featureing of ribs on block and head and design space creation saved 70% time compared to the conventional approach.
- Due to CAD Morpher used, an optimized CAD model could be given directly to the design team.

**CAD Morphing**

- **D Ring Top Section**
- **Cowl Bar Section**
- **2nd Cross bar Section**

**The Result**

DEP's parameterization based MDO approach using MeshWorks helped to save about 12% of mass by still meeting all the performance targets.