



InDepth

Engineering Solutions

**AUTOMOTIVE
SERVICES**



DESIGN



ANALYZE



ENGINEER



ABOUT US

InDepth Engineering Solutions is a mechanical engineering consulting firm recognized for its commitment to providing the highest level of quality service to the automotive industry. Over the years, we have catered to the demands of passenger car, EV/HEV, alternate fuel, commercial & specialty vehicle industries. With a multi-disciplinary team of engineers, we have achieved tremendous success in projects involving full vehicle, body structure, chassis, suspension, powertrain, seating system and various other interior and exterior systems.

Our Competencies:

- Ideation and Concept Design
- Mechanical Systems Design
- CAD Modeling and Fabrication Drawings
- Computer Aided Engineering (CAE)
- Root Cause and Failure Mode Analysis
- Reverse Engineering
- Prototype and Fabrication
- Instrumentation and Testing
- Program Management
- Technical Documentation

OUR CAE CAPABILITIES

We use the most advanced simulation software to drive product design, reducing the need for expensive prototype testing. Our key areas of expertise include:

Crash Analysis

- Industry Standard Crash Test Simulations
- Occupant Safety and Pedestrian Protection
- Aluminum, High Strength Steel and Composite Simulation
- FEA and Test Correlation

Noise and Vibration

- Modal Analysis
- Frequency Response Analysis
- Random Response and PSD
- Point Mobility

Multi-Body Dynamics Simulation

- Rigid and Flexible Multi-Body Systems
- Mechanism Analysis
- Vehicle Dynamics and Load Development
- Tire Modeling and Simulation

Durability and Fatigue

- Linear Stress Analysis
- Stiffness and Strength
- Highly Non-Linear / Rubber Hyper-Elasticity
- Contact Problems
- Low and High Cycle Fatigue

Computer Aided Optimization

- Topology, Topography and Topometry
- Design of Experiments
- Design Sensitivity Analysis
- Response Surface
- Multi-Disciplinary Optimization (MDO)

Thermo-Mechanical Analysis

- Conjugate Heat Transfer Simulations
- Thermal Stress Problems



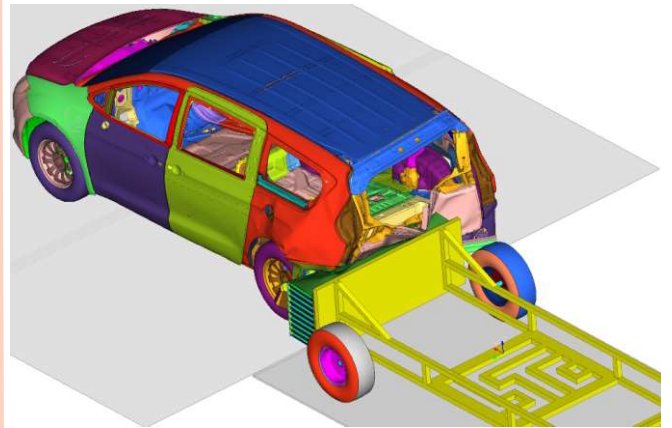
With a passion and perseverance for excellence, we continue to provide innovative design solutions for projects across the globe.



BODY STRUCTURE AND CLOSURES

Our CAE driven processes help design automotive body structures and closures that are effective crash energy management systems, while achieving best-in-class durability and NVH characteristics. Some of our past projects are:

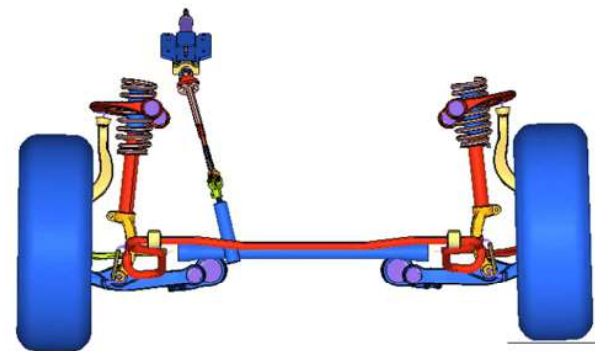
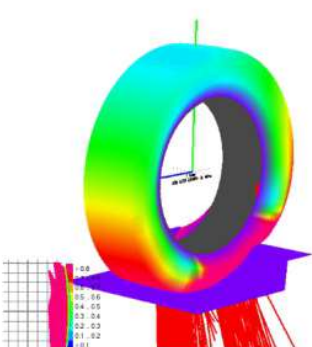
- Development of aluminum front rails and crush cans for cargo van.
- Optimize aluminum body-in-white for crash, durability & NVH requirements in passenger car application.
- FMVSS crash test simulations and durability analysis during the conversion of OEM minivan to mobility vehicle.
- Predicting the dynamic crush behavior of carbon fiber composite front bumper and crush can.
- Sag/set, over check, intrusion, stiffness, slam simulations of closures.



CHASSIS AND SUSPENSION SYSTEMS

We provide a complete suite of CAE services towards development of efficient chassis and suspension components. Simultaneous use of multi-body dynamic simulations, FEA and computer aided optimization have helped our clients reduce their product development cost and time significantly. Few of our achievements include:

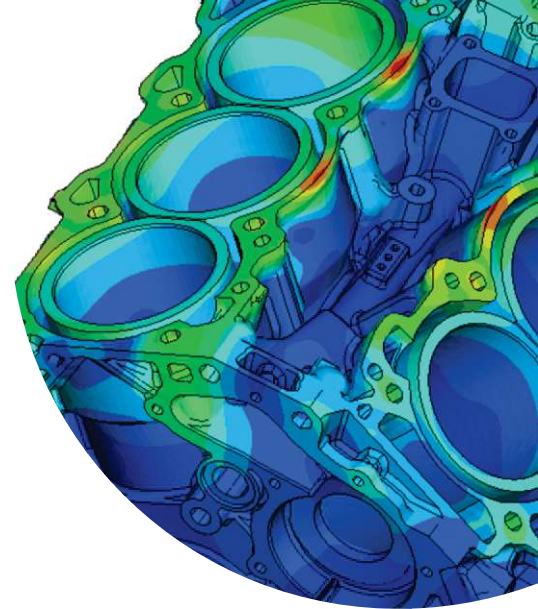
- Chassis design for commercial vehicle using loads developed from MBD analysis.
- Crush system design for an OEM chassis to protect after-market installed propane tanks.
- Optimization of control arms and steering knuckle for mid-size SUV.
- Conversion of vehicle leaf spring rear suspension to kneeling air ride suspension.



POWERTRAIN ENGINEERING

InDepth's powertrain CAE expertise includes conventional as well as electric and hybrid systems. Some of our highlight projects are:

- Fatigue life analysis of engine block, head and crankshaft due to thermal and mechanical loads.
- Benchmark NVH performance of conventional pick-up truck and assist in its conversion to hybrid.
- Optimization of intake manifold for acoustic and vibration performance.
- Design and validation of battery enclosures.
- Steady state and transient heat transfer analysis at cell, battery module and battery pack level to optimize cooling system.



VEHICLE INTERIOR AND EXTERIOR SYSTEMS



We have gathered extensive experience in automotive seating systems by collaborating with Tier 1 and 2 suppliers over the years and we offer complete CAE support to analyze and optimize seats to meet all FMVSS/ECE safety standards along with client specific NVH and durability requirements.

Our expertise by seat type:

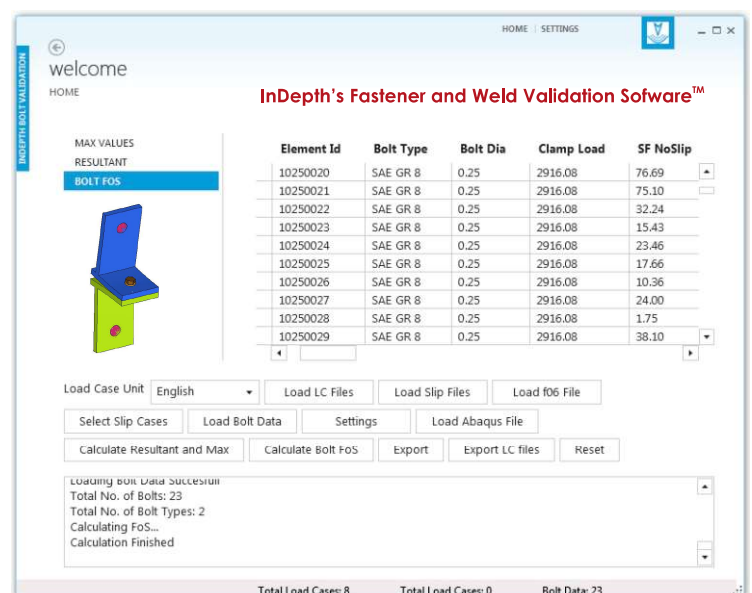
- Driver/Passenger
- Bench/Split
- Manual/Power
- Air Ride
- Captain
- 2/4/6/8 Way
- Folding/Stow
- Mobility Transfer

In addition to this, we are proficient in the engineering and analysis of steering columns (manual/power and tilt/telescope), instrument panel, grab handle, overhead console, A/B/C pillar trims, door trims and head/tail lamps.

FASTENER AND WELD VALIDATION SOFTWARE

Over the past few years, we have developed an advanced tool to comprehensively and efficiently assess bolts, rivets and pins used across various vehicle systems. With data from coupon testing, this software has been extended to evaluate spot welds and seam welds as well. Highlights from the latest version are:

- It comes with an intuitive and user friendly GUI.
- Automatic extraction of forces/moments from FEA solver output formats such as F06 (Nastran) and DAT (Abaqus).
- Inbuilt library of standard SAE/ASTM bolt data.
- Calculates FOS in tension, shear and slip.
- Optimized to handle large data.
- All the calculated data can be exported to an excel spreadsheet for custom post-processing.





WHY PARTNER WITH US?

Our Experience: With over a decade of experience in the automotive industry, we are well poised to meet the industry challenges.

Custom Solutions: We assess each project's requirements individually and develop solutions that are tailored specifically to suit your needs.

Latest Technology: By keeping abreast with technological advancements, we bring in the latest innovations into our design solutions.

Concurrent Design & Engineering: Upstream and simultaneous design and CAE minimize design iterations and prototype build resulting in reduced time-to-market.

Engineering Team: Our designers and engineers bring in expertise from different disciplines, offering a winning recipe for any program.

Customer Service: We take personal pride in our work, thus delivering the highest quality of service. This has resulted in continued collaborations and lasting relationships with our clients.

OUR TOOLS

 MSC Nastran

 SIMULIA
ABAQUS

 ANSYS

 LS Dyna
Oasys
PRIMER

 Adams



Altair

HyperWorks®

HyperMesh™ RADIOSS™
MotionSolve™ AcuSolve™
HyperStudy™ OptiStruct™

Altair Partner Alliance

nCode  DesignLife

cosin
scientific software

 AUTODESK®
MOLDFLOW®

 SOLIDWORKS

 CATIA

 AUTODESK
INVENTOR

 AUTODESK®
AUTOCAD®

 SIEMENS
NX

 AUTODESK®
ALIAS®

CAPABILITIES

Ideation and Concept Design
Mechanical Systems Design
CAD Modeling and Fabrication Drawings
Computer Aided Engineering (CAE)
Root Cause and Failure Mode Analysis
Reverse Engineering
Prototype and Fabrication
Instrumentation and Testing
Technical Documentation

CAE EXPERTISE

Durability and Fatigue
Crash Analysis
Noise and Vibration
Computer Aided Optimization
Multi-Body Dynamics (MBD)
Thermo-Mechanical Analysis
Computational Fluid Dynamics (CFD)
Manufacturing Simulations
Weld and Fastener Assessment
Steel, Aluminum, Plastics & Composites

AUTOMOTIVE EXPERTISE

Full Vehicle
Body Structure and Closures
Chassis and Suspension
Seating and Steering Systems
Interior and Exterior Trims
Powertrain Engineering

STANDARDS

US: FMVSS, IIHS, NCAP
Europe: NCAP, UN ECE
China: GB, NCAP
SAE
OEM Standards

INDUSTRIES SERVED

Automotive
EV/HEV and Alternate Fuel Vehicles
Commercial Vehicles (Bus & Truck)
Specialty Vehicles (Mobility & RV)
Amusement and Themed Entertainment
Consumer Products
Aerospace
Medical Devices

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