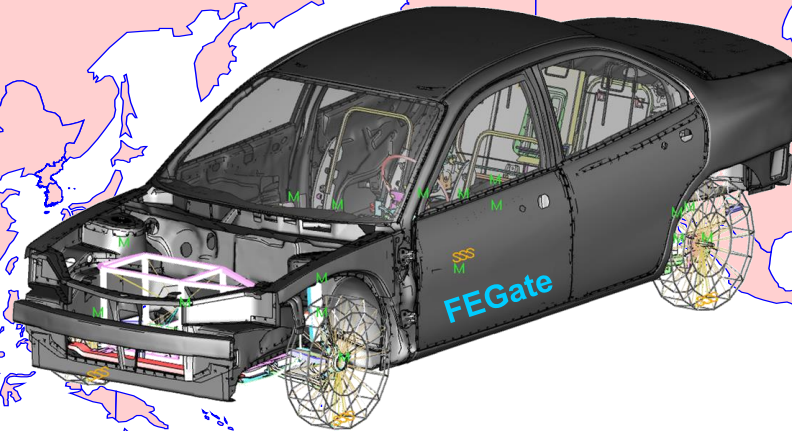

INTRODUCTION



SVD INC.

FEGate 개발배경

FEGate는 25년 이상의 진동소음 및 구조해석 경력을 가진 해석 엔지니어들에 의해 자동차회사 내에서 신차개발 업무를 위해 개발된 Pre/Post Processor 입니다.

기존 상용 S/W (IDEAS, PATRAN, NVH_MANAGER, ANSYS, FEMAP, FEMBY, HYPERMESH등)의 사용자가 직접 해석작업을 하면서 N&V 및 Structure 해석을 위해 요구되는 기능 및 해석기술을 집약하고, 자동화하며, 기존 S/W의 기능들을 보다 더 개선하여 업무효율이 극대화 되도록 현장의 목소리를 보다 더 충실히 반영하여 만든 Tool 입니다.

국내 완성차 업체의 자동차 개발경험과 CAE 활용 역사는 그리길지 않지만, 현대-기아자동차와 한국GM, 쌍용자동차와 같은 후발업체는 한국인의 부지런함과 근면성을 기초로 빠른 시간에 다양한 해석작업으로 차량개발을 진행하여 Global 경쟁력을 다져가고 있습니다.

해석엔지니어들은 빠른 설계검증을 할 수 있도록 업무효율을 높일 수 있는 방법을 항상 찾고 있으며, 다양한 S/W의 장점을 부분적으로 이용하여 해석업무에 활용하기도 하지만, N&V와 Structure분야에서는 현장의 Needs가 가장 충실히 반영되어있는 FEGate를 Platform으로 하여 대부분의 Pre/Post Processing작업이 이루어지고 있으며, 또한 현장에서 필요로 하는 새로운 기능을 거의 Concurrent하게 개발하고 지원하여 업무효율을 높이고 있는 상황입니다.

대부분의 Pre/Post Processor와 기능적으로는 70~80% 이상 overlap 되어있겠지만, 똑같은 기능을 사용하기 위해 수행되는 작업과정에는 제품간에 많은 차이가 발생하고, 효율성 면에서 차이가 크게 발생하여 그것이 바로 제품의 시장경쟁력으로 나타나게 됩니다. 이러한 효율성 면에 있어서 FEGate는 사용자들에게 크게 어필되고 있으며 이로 인하여 사용자의 충성도(혹은 중독성)가 매우 강한 S/W 입니다.

실제로 N&V 와 Structure 관련하여 크고 복잡한 모델에 대해 해석작업을 진행할 때 다른 경쟁 S/W 비해 업무효율을 높일 수 있음을 바로 체감할 수 있으며, 발생 가능한 오류를 경쟁 S/W 대비하여 최소화 시켜주는 차별화된 기능을 갖고 있습니다.

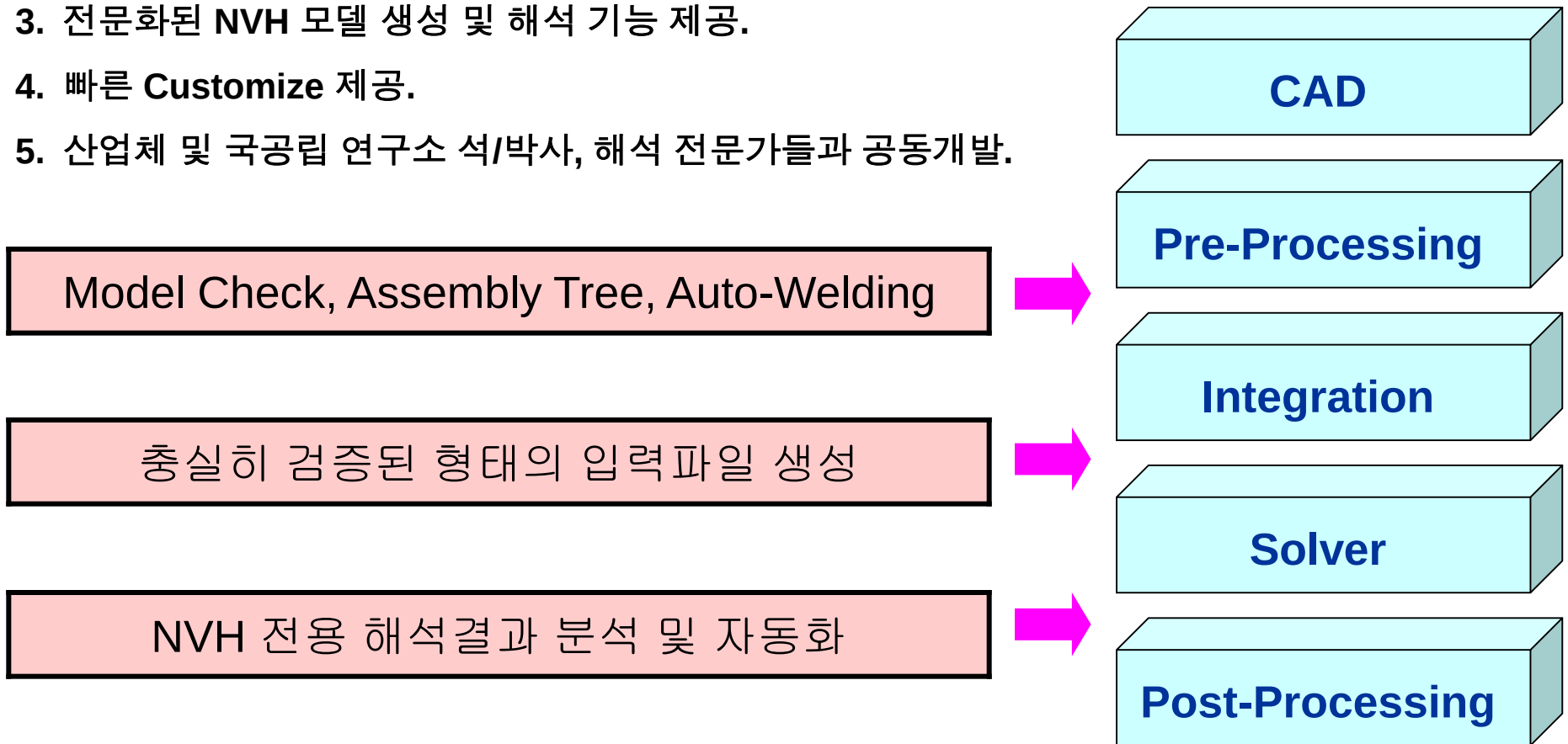
최근의 해석업무는 FE 모델을 인도에서 작업해서 받고, 파트 용접, 시스템 결함 및 구성, 완성차모델 구축은 크고 복잡한 시스템들을 세밀히 연결하고 관리해야 되기 때문에 해석엔지니어들이 직접 구성하는 형태로 진행하고 있고 이때 FEGate의 진가가 나타납니다.

최근의 NVH 해석작업은 다양한 시험데이터를 이용하여 TEST/CAE Correlation 작업과 시험에서 구한 실측하중을 해석모델에 추가하여 진동소음 전달경로 해석과 같은 작업이 수행되는데, FEGate는 시험데이터를 이용한 NVH 해석작업에 필요한 기능을 제공하고 있습니다.

FEGate는 단지 몇 가지의 Unique한 기능 때문에 시장경쟁력을 갖고 있는 것은 아니고, 경쟁 S/W에 Overlap된 기능에 있어서 상대적으로 짧은 Step과 다양한 방법으로 동일한 기능이 수행되도록 User Friendly 하게 구성되어 있기 때문입니다.

FEGate 특징

1. 시각적 / 직관적인 환경과 사용자 편의적인 선택/수정 기능.
2. 기능별로 자동화 및 단축화된 명령 실행 기능.
3. 전문화된 NVH 모델 생성 및 해석 기능 제공.
4. 빠른 **Customize** 제공.
5. 산업체 및 국공립 연구소 석/박사, 해석 전문가들과 공동개발.



Selection Tools

매우 다양하고 특화된 선택기능을 제공하여 사용자가 원하는 작업범위로 빠르게 접근할 수 있도록 기능 구현
하나의 Element나 Node의 구성에서부터 Sub-System 및 Total System에 이르기까지 세밀하고, 복잡한 대상을 하나의 객체로 분류, 선택, 체크, 수정을 하면서 시각적이고 직관적으로 해석 모델을 구성하고 결과를 확인할 수 있도록 되어있음.

- Basic F5,F6,F7,F8 Functions
- Boolean / Buffer Operation - Add / Erase
- Relation
- Group
- Masking (Show ↔ NoShow)
- Selection By Misc. Attributes
- Find Adjacent Node (ADJ)
- Node Path Selection
- Shell Face Selection
- Value Search
- Various Point / Vector / Distance / Plane Definition
- Assembly Tree (ctrl - t)

Value Search & Group:

Find property groups having identical value for a given property item, And create element groups for each values.

Display Selected

Selection Mode
☒ replace ☐ add ☐ erase
☐ skip hidet

Selection Filter
☒ Element
☐ Node
☐ Coordinate System
☐ Boundary Condition
☐ Point
☐ Curve
☐ Surface

all off all on

attribute list...
 group...
 misc. attributes...
 value search...
 label range...

select last displayed
 select last op. group
 clear selected

accept apply cancel

Property Value Edit

physical material
 property types:
 LINEAR BEAM
 SHELL
 RIGID ELEM
 SPRING
 DAMPER
 LUMPED MASS

item names:
 Membrane Thickness
 Bending M.O.I Ratio
 Transv. Shear Thickness Rat
 Non-Structural Mass/Area
 Fiber Distance Z1
 Fiber Distance Z2

properties:
 1: FRT_END_SIDE
 2: INTERM_FLR
 3: RR_FLR
 4: FRT_FLR
 5: RAD_SUPT_UPR
 6: RAD_SUPT_LWR
 7: FRT_END_UPR
 8: FRT_END_LWR
 9: LONGI_UPR
 10: LONGI_MBR_LWR
 11: FENDER_APRON_MBR_INR
 12: FENDER_APRON_OTR

all clear
 value: 0
 set value
 add multiply
 value group...
 return

Display/Select
 Add Related Entity (^+)
 Add Related Part (^~)
 Last Displayed (@F5)
 Reverse (^F5)
 Display...
 Add...
 Erase...
 Group...
 Mask...

Erase
 Erase By Attribs (^F7)
 Erase Selected (^F6)
 Erase Last Displayed
 Erase Operation Group

Mask
 Masking
 Mask Hidden
 Swap Masked
 Unmask All
 Unmask Related Node
 Unmask Related Elem

Display
 Display Part (F8)
 Display By Attribs (F7)
 Display Selected (F6)
 Display All (F5)
 Show Operation Group (^O)

Group
 Manage Group
 Create Group
 Value Group
 Show Current Group
 Add To Cur. Group
 Erase From Cur. Group

Add
 Add All Related
 Add Related Entity
 Add Related Part
 Add Related Nodes
 Add Related Elements
 Add Related BC & CSys
 Find Adjacent Nodes
 Add Last Displayed
 Add Operation Group

Model Check

Model Diagnosis	
commands	
part undefined isolated entities internal free edge duplicated - within part duplicated - across parts dependency mesh quality shell normal consistency weld element check anchor check rigid link rigid free leg rigid free center (n < 4) unbounded rbe3 free end - axial free end - rigid (< tol) free end - beam (< tol) not fully fixed rbe2 zero property psHELL mid1 != mid2,3	

solid property model summary part summary - dim & mass part summary - mesh quality part summary - label range material summary file id summary connector summary	
all	rev clear
options:	
☒ skip masked entities	
free end tolerance:	1.
anchor search depth:	5.
mesh quality:	fatal
DIAGNOSE	
exec related command...	
show output groups	
remove output groups	
manage group...	
return	

--- check ---

Part Undefined

Isolated Entities

Internal Free Edge

Duplicated - Within Part / Across Parts

Dependency

Mesh Quality (Normal / Fatal)

Shell Normal Consistency

Weld Element Check – Edge Intrusion, Projectivity, Patch Angle ...

Anchor Check

Rigid Link / Rigid Free Leg / Rigid Free Center (n < 4)

Unbounded RBE3

Unbalanced RBE3

Free End - Axial / Rigid / Beam

Not Fully Fixed RBE2

Zero Property

PSHELL MID1 ≠ MID2,3

Acoustic Model Validation

--- report ---

Solid Property

Model Summary

Part Summary - Dim & Mass / Mesh Quality / Label Range

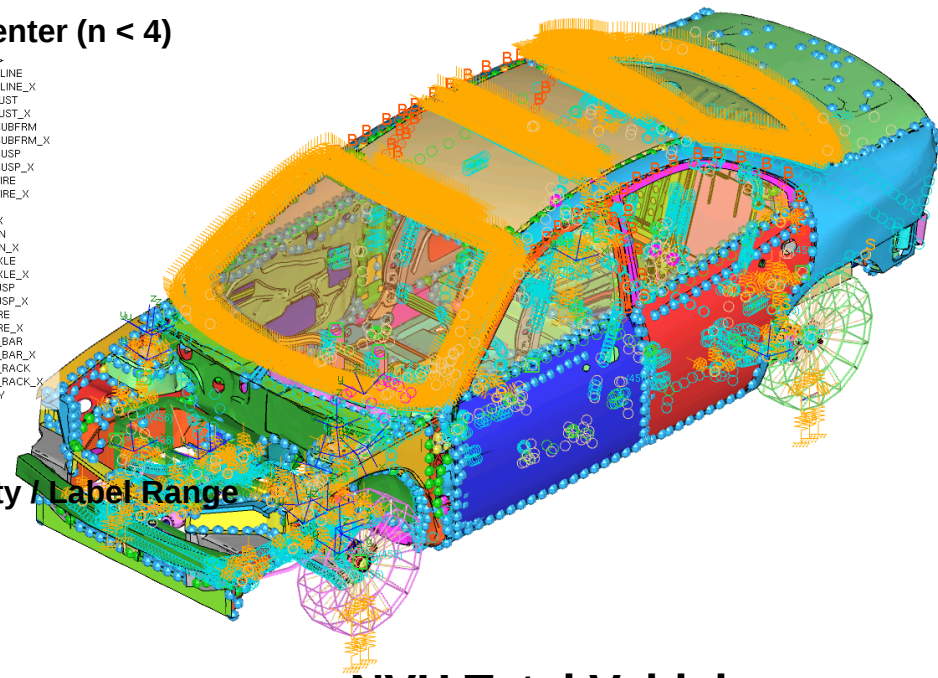
Material Summary

File ID Summary

Connector Summary

크고 복잡한 해석모델의 완벽한 모델 Check 및 진단 기능을 제공

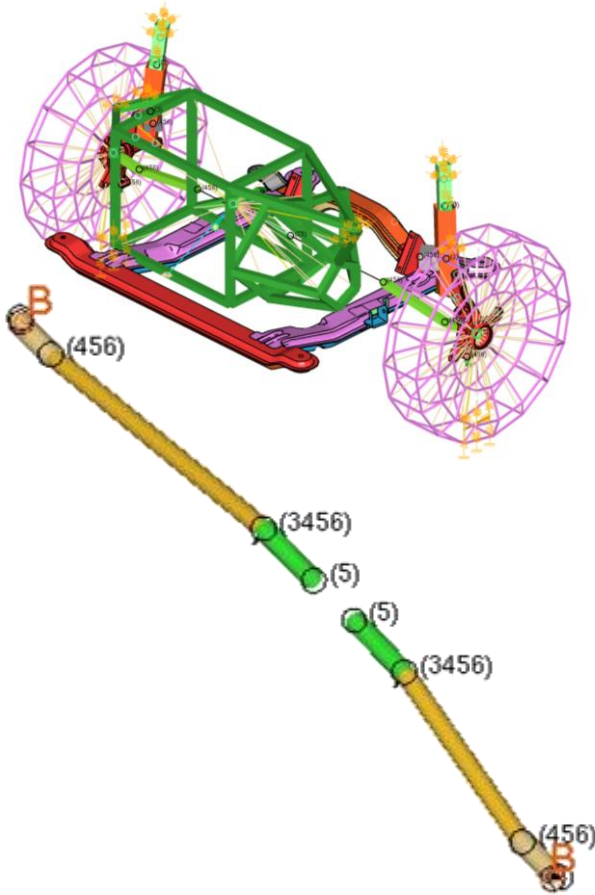
[->ROOT-]
[->DRIVELINE_X
[->EXHAUST
[->EXHAUST_X
[->FRT_SUBFRM
[->FRT_SUBFRM_X
[->FRT_SUSP
[->FRT_SUSP_X
[->FRT_TIRE
[->FRT_TIRE_X
[->LCA
[->LCA_X
[->PTRAIN
[->PTRAIN_X
[->RR_AXLE
[->RR_AXLE_X
[->RR_SUSP
[->RR_SUSP_X
[->RR_TIRE
[->RR_TIRE_X
[->STAB_BAR
[->STAB_BAR_X
[->STRG_RACK
[->STRG_RACK_X
[->TBODY



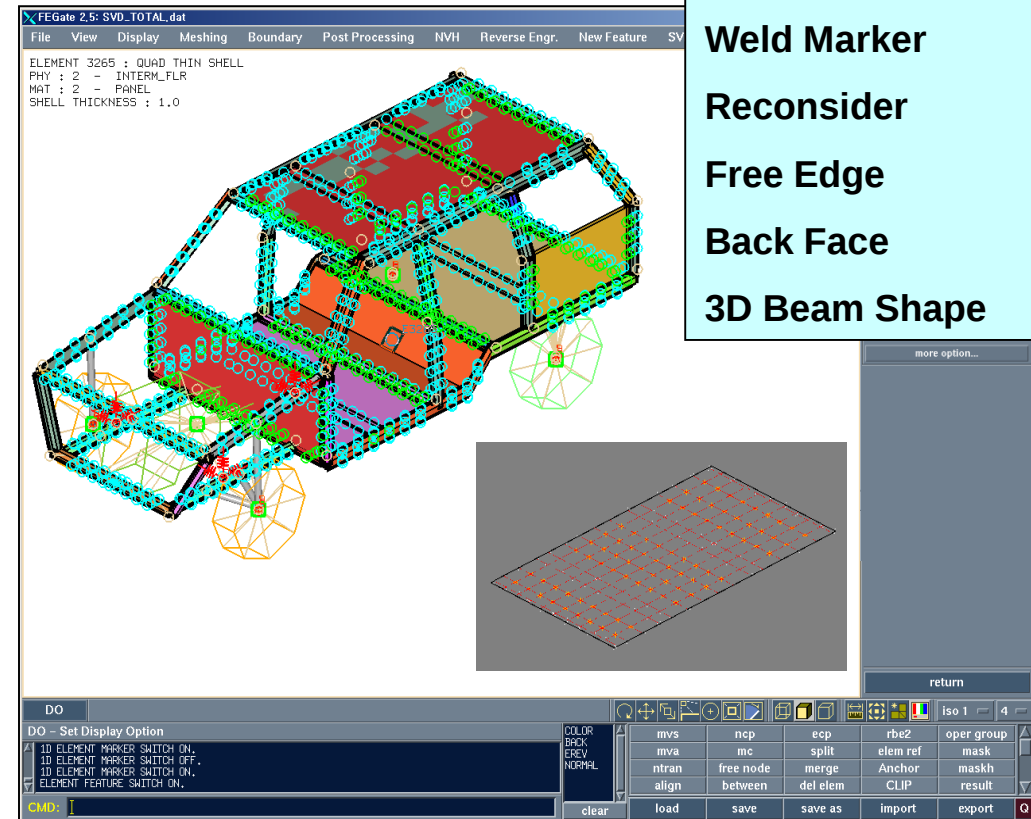
NVH Total Vehicle

Model Check

N&V 및 Structure 모델의 특징은 RBE2, RBE3, MPC, Mass, Bush, Spring 등의 1D Element를 이용하여 Part간 또는 System간 결합 및 Mechanism 구성조건으로 많이 사용하는데, 한두 Step을 통해 복잡하게 구성된 결합조건을 시각적으로 체크할 수 있고, 잘못 구성된 부분만 바로 선택하여 수정 할 수 있도록 지원



Display RBE2 Released DOF to Check Chassis System Mechanism



On-Line Check

Weld Elem Color

Weld Marker

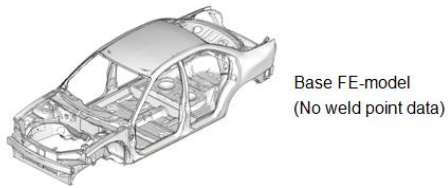
Reconsider

Free Edge

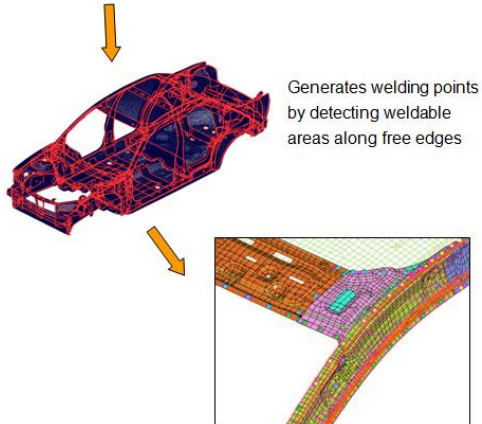
Back Face

3D Beam Shape

Automation

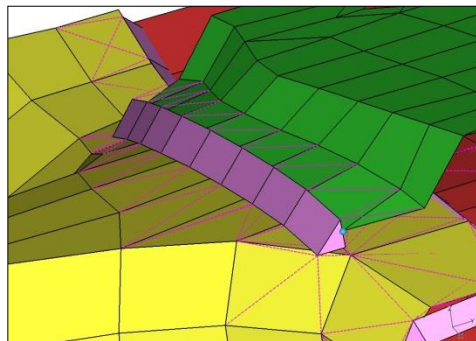


Base FE-model
(No weld point data)

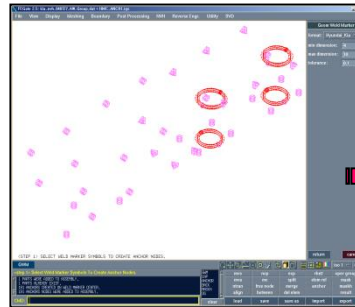


Generates welding points
by detecting weldable
areas along free edges

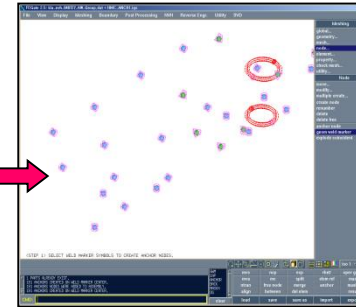
One step along edge spot weld
generation for concept design stage



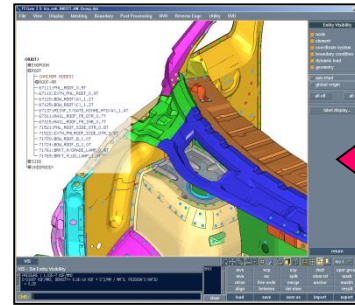
Powerful seam wedge welding for Lap, Butt or T-Joint



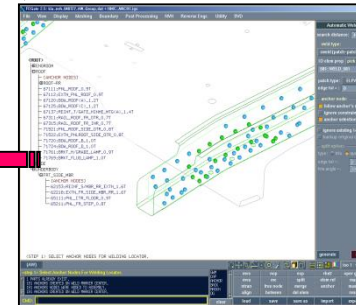
Import Welding Points - CAD



Automatic Shape Detection

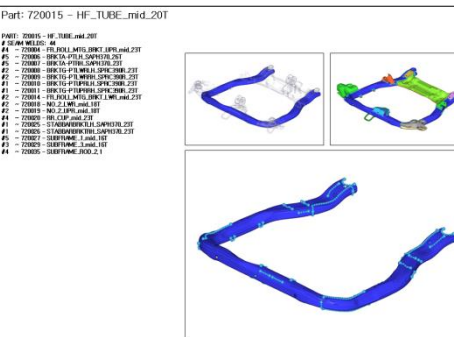
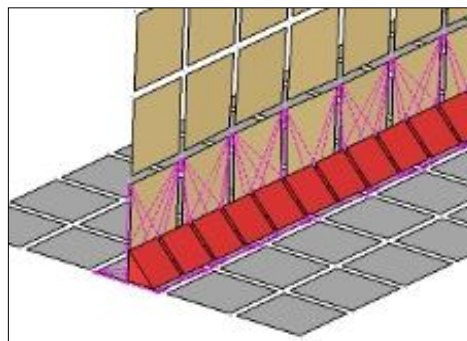


Auto-Welding Result



Created Anchor Nodes

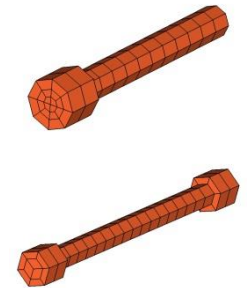
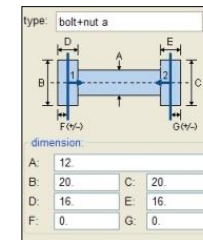
Automatic Weld Generation with CAD



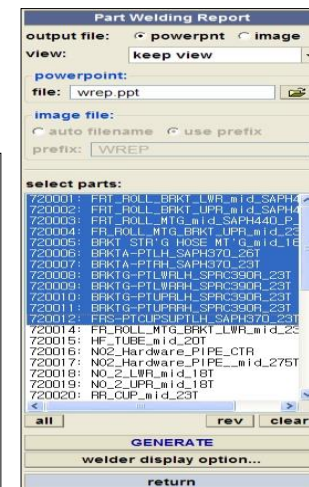
Weld Report Generation (PowerPoint)

강력한 자동용접 기능(CDH, RSM, NASTRAN CWELD, ABAQUS FASTENER, DYNA BEAMPID등) 과 자동

용접점 생성기능 및 서로 다른 용접형태의 변환, 용접요소의 에러체크, 자동수정기능을 제공

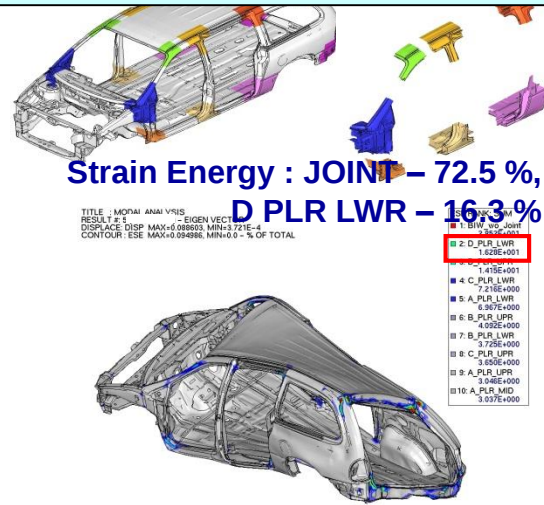
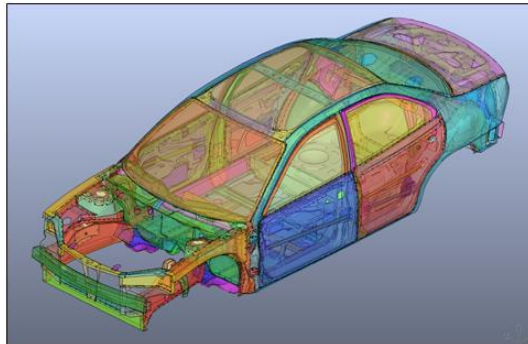
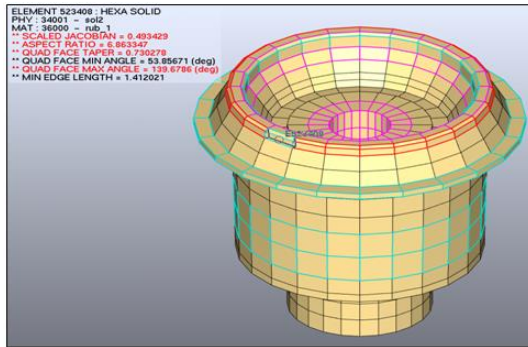
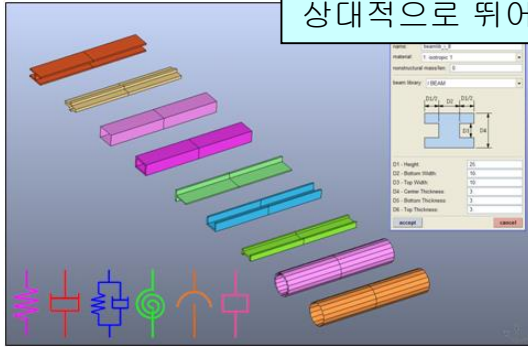


Simple Solid Bolt Mesh



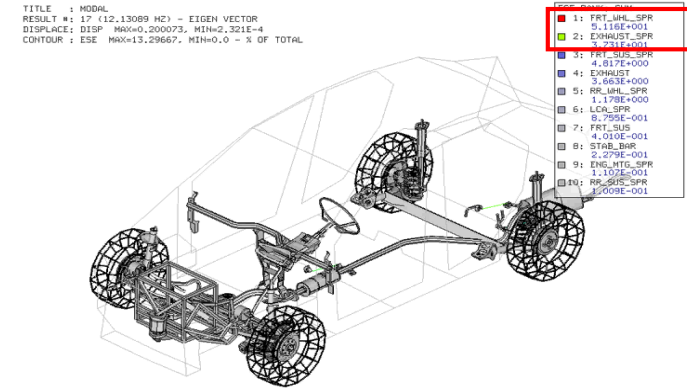
Visualization

상대적으로 뛰어난 시각화 기능을 지원하므로 이를 통하여 FE 모델의 직관적인 이해가 가능



Group Ranking - BIW JOINT Strain Energy Analysis

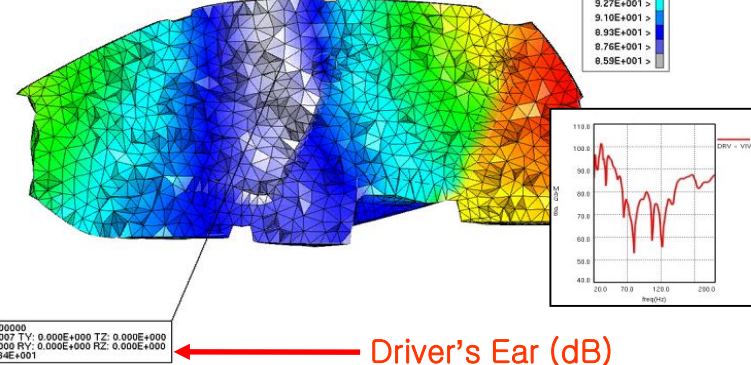
Strain Energy : FRT Tire - 51 %, Exhaust - 37%



Group Ranking - Chassis System Strain Energy Analysis

RESULT # 1 (20.0000 HZ) - DISPLACEMENT MAGPHASE
DISPLACE: DISP MAX=13.320E-4, MIN=3.957E-7
TRANS MAG: DISP MAX=104.4245, MIN=85.9261 [DB]

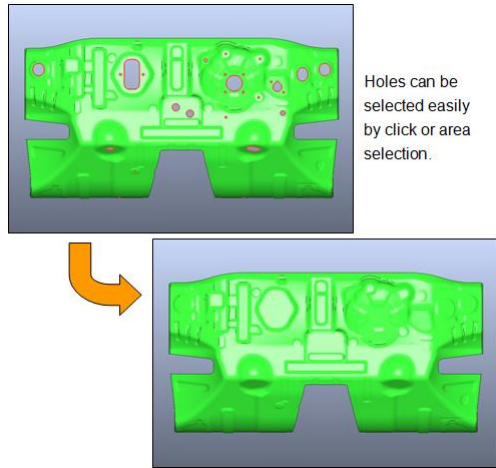
WOT-C2 Engine Full Load Sound Pressure Contour



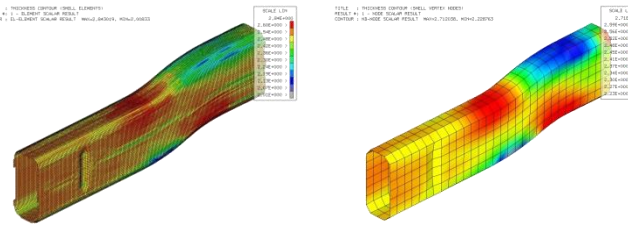
High quality transparency

Driver's Ear (dB)

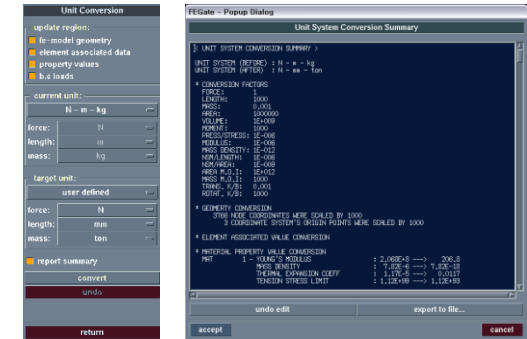
Utility



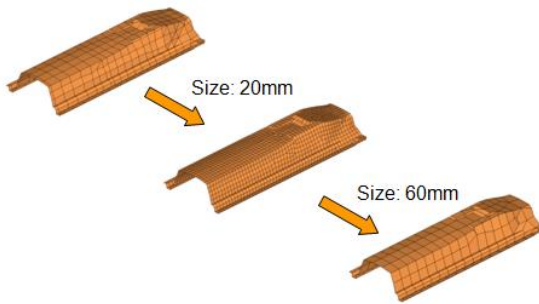
Automatic hole filling



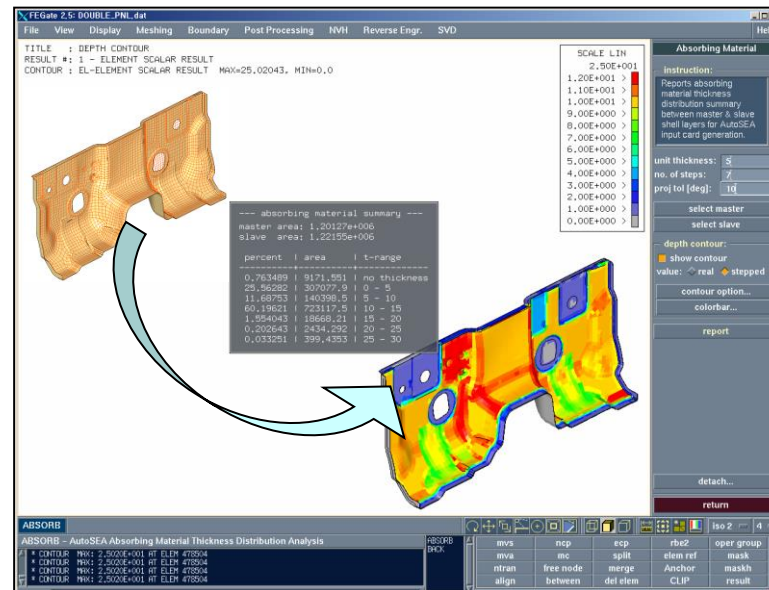
Hydro-formed thickness mapping



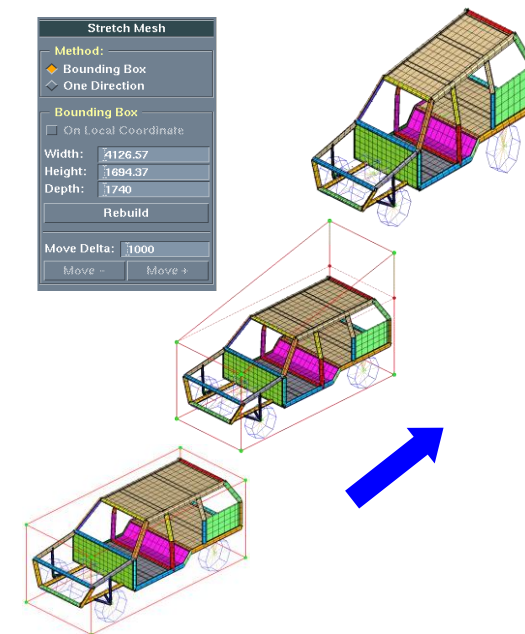
FE-Model unit conversion



Shell remesh for mesh quality improvement

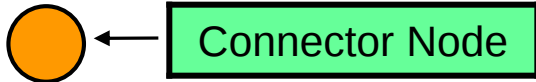
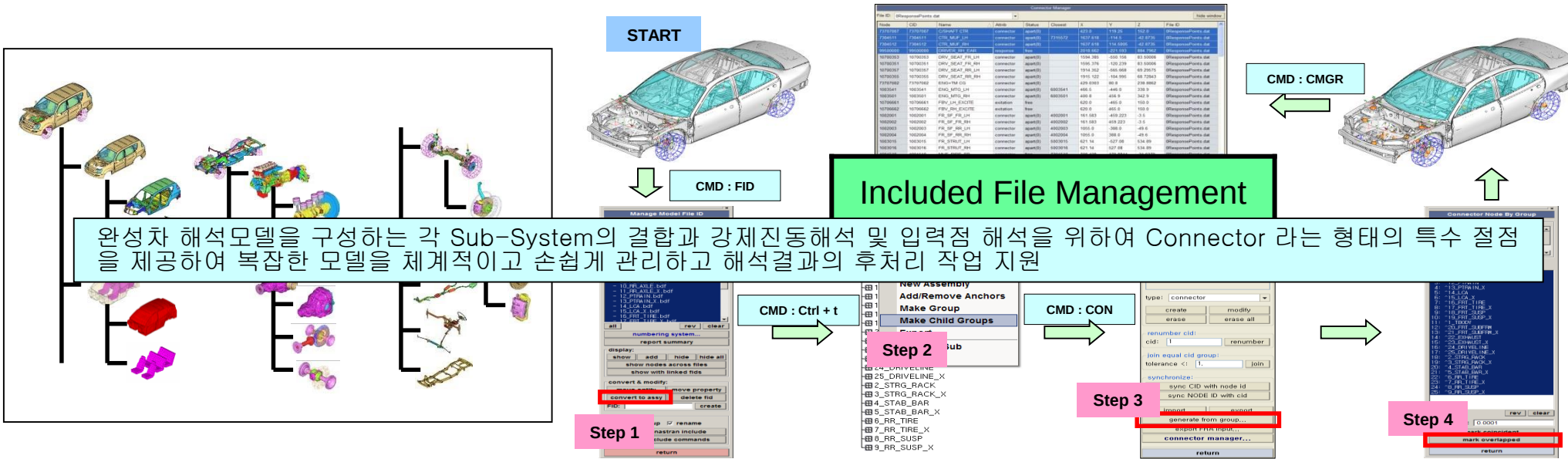


AutoSEA – Absorbing Material (Thickness Contour)



Stretch Mesh – Bounding Box

Process Management

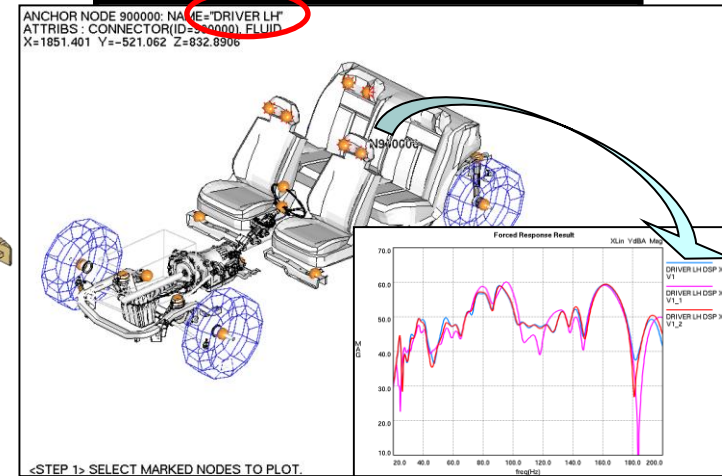
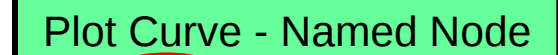
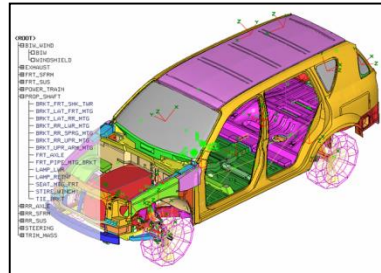


<Usage>

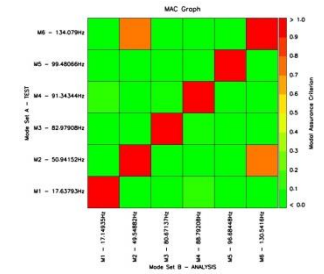
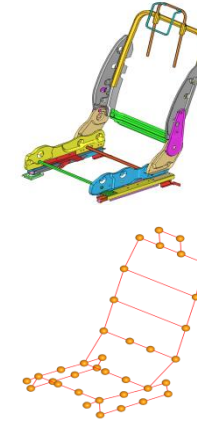
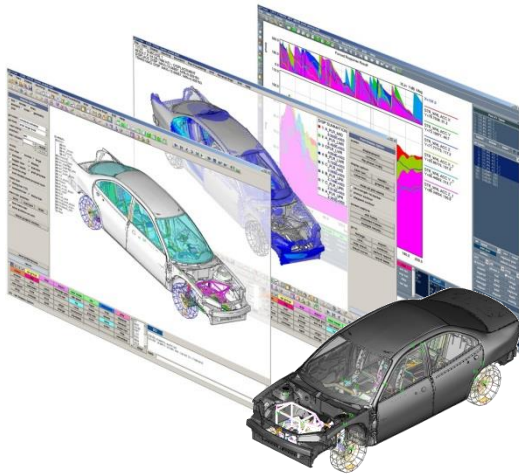
1. Excitation Node
2. Response Node
3. Connection Node

<Feature>

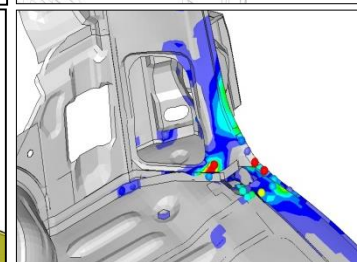
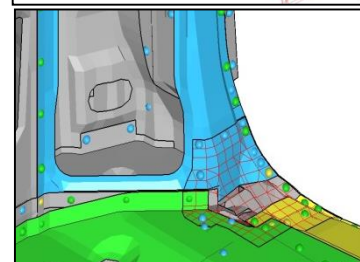
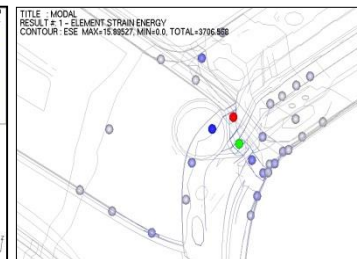
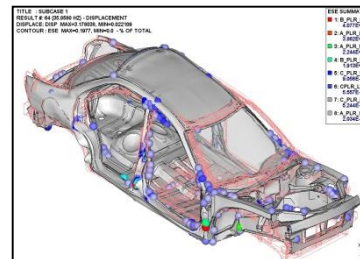
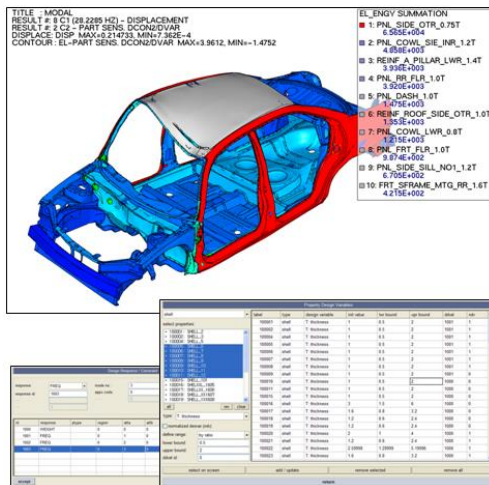
1. Always Keeps Important Node Numbers For Ready-Made Analysis Input Files
2. Has Unique Node Name Instead of Meaningless Number
3. Has 1st Priority For Merge & Deletion
4. Automatic & Safe Connection of Imported Subsystem Using Connector Information
5. Automatic Connector Generation Between Sub-Systems
6. Manages Excitation or Response Point for Forced Response Analysis



NVH Technology

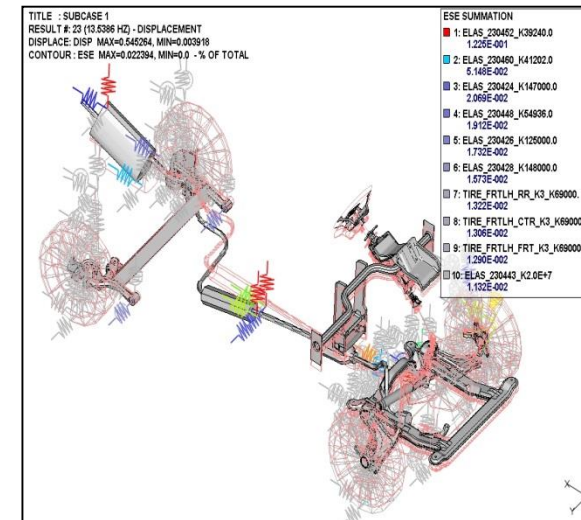


MAC Value Calculation & MAC Graph Plot



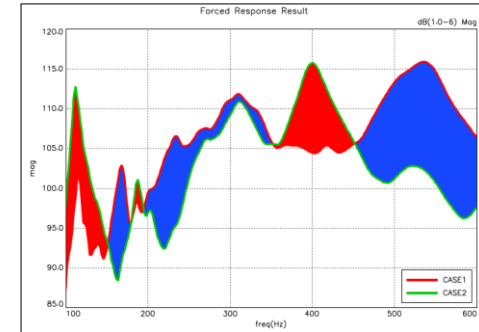
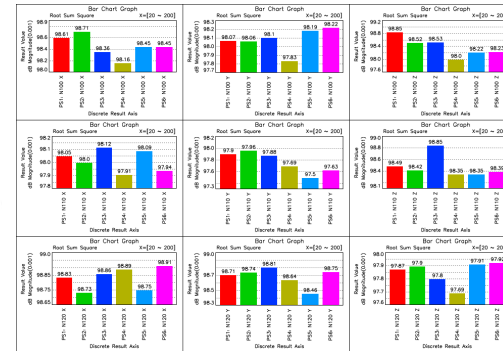
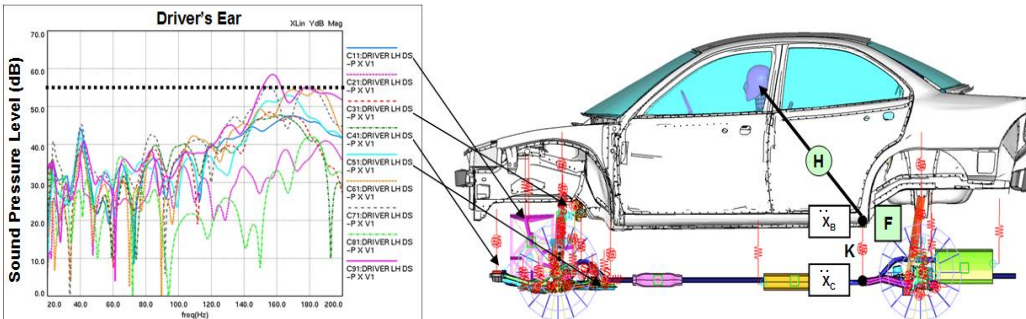
Design sensitivity analysis input generation & Post processing of sensitivity analysis results

Modal Analysis with spot weld marker contour for welding point energy contribution analysis



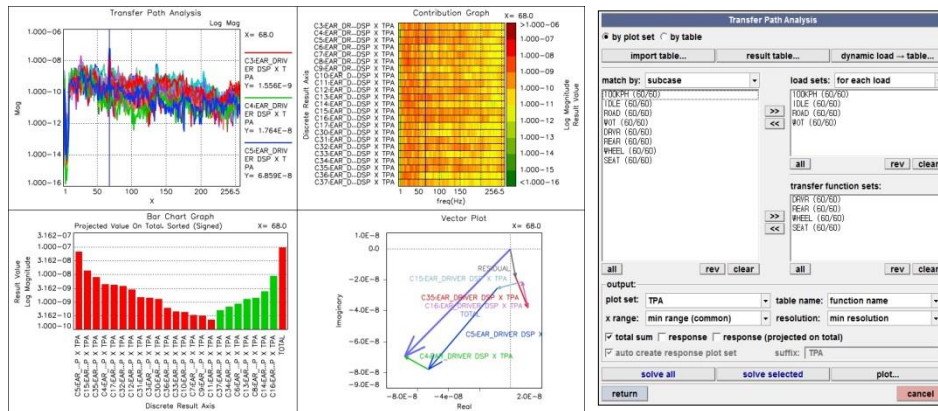
Modal Analysis with zero length 1D marker for examining low frequency chassis modes

NVH Technology

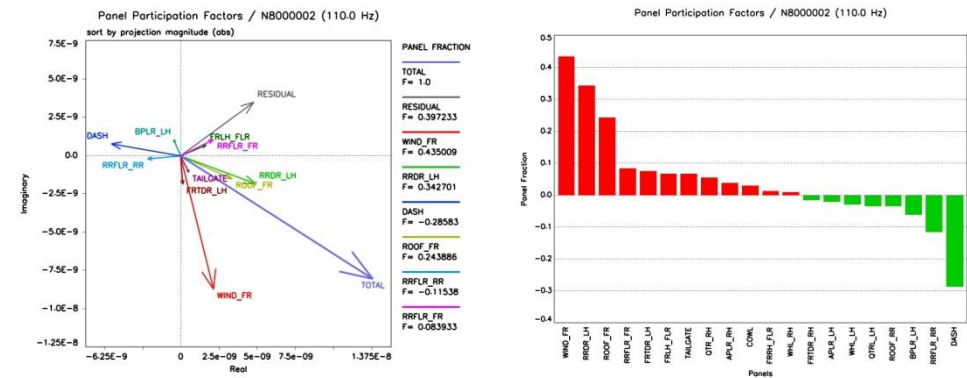


Multi Plot For Comparing Many Cases With Statistics Value Bar Chart

Fill Plot For Comparison

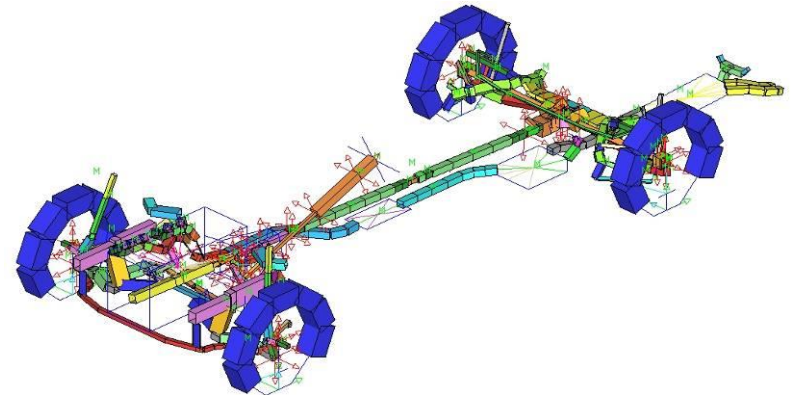
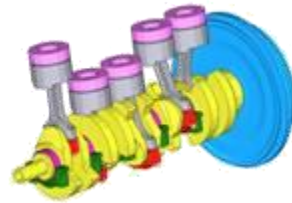
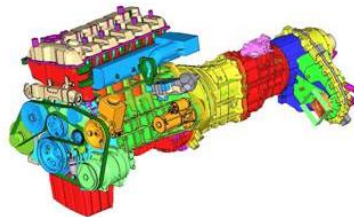
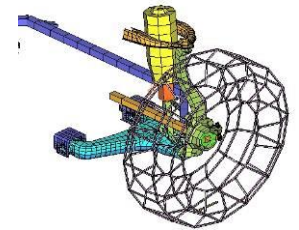
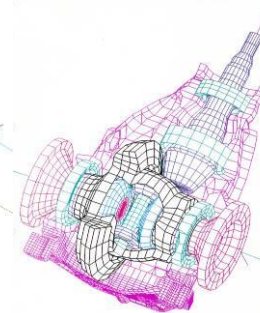
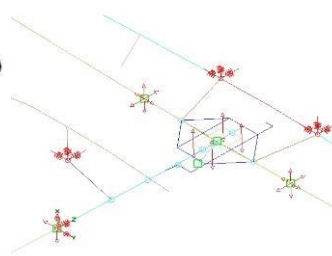
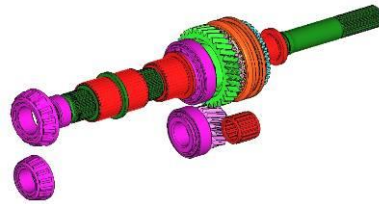
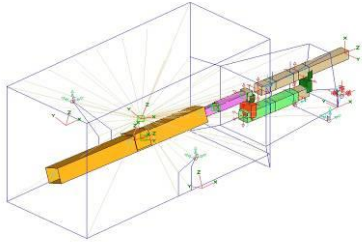
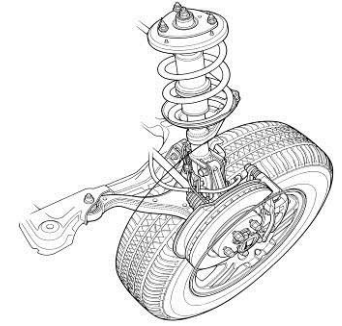
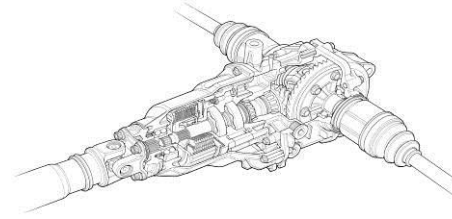
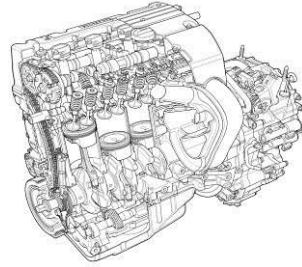
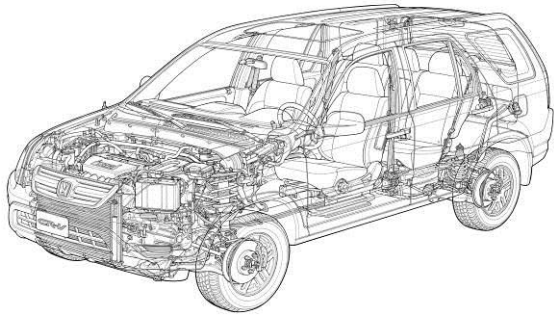


Transfer path analysis tool & Multi-plot for output process (Contribution Graph, Bar Chart, Vector Plot)



Modal Participation Factor / Panel Contribution Analysis

NVH Engineering Consulting



FEGate Customers

