REALISTIC VISUALIZATION OF CRASH SIMULATION RESULTS

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3DEXPERIENCE®
Overview

- ~1800 associates and contractors
- Develop NA and global models for Honda and Acura brands
- Developed NA Light Truck platform

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Testing Facilities

State-of-the-Art Crash Barrier

100 Ton Moveable Block

World’s First “Pitching” Capability
Safety Leader

Honda has more Top Safety Picks than any other manufacturer.
- Publicly recognized as a safety leader.

Honda and its luxury brand, Acura, took home the most 2014 Top Safety Pick Plus awards of any automaker from the Insurance Institute for Highway Safety. Of the 22 vehicles that earned an IIHS Top Safety Pick Plus award for 2014, Honda and Acura account for six of them, including the Honda Accord sedan and coupe, Honda Odyssey, Honda Civic sedan, Acura RLX and Acura MDX.
Advanced Safety Structures

Typical Body Construction

Advanced Compatibility Engineered Body developed in 2005

2nd ACE™ Body

AHSS Continuous Ring Concept

59% of body is Advanced High Strength Steel (AHSS)

Load is smoothly transferred through the joints

Material innovations helps reduce weight of body
(‘14 MDX body was 100 lbs lighter than previous model)

Honda R&D Americas, Inc. November 2014
Frame Performance CAE

Body Modal Analysis

Suspension Strength

Several types of CAE used to set performance specification of parts and assemblies

Spot Weld Fatigue Life

Crash

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Crash CAE Model Details

One very detailed vehicle FE model for consistency

Details Include:
4000 Parts, 5000+ Spot Welds, bolts, fuel and brake lines, fuel in tank, glass
Material and joint failure critical for accuracy compared to physical tests.

MODEL IS SOLVED USING LS-DYNA – a non-linear explicit finite element code.

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Developing a Vehicle

Past Development Process

Concept/Styling: Scanned surfaces from clay

Design: Turn surfaces into CAD
- Make drawings
- Senkosha/Mule Car built to try design concepts

CAE: Mature part design/concept

Mass Production Tools: Prototype vehicle testing 60+ cars
- Test confirmation of MP vehicle

Virtual Development Process

Scanned surfaces to 3D

CAD/Digital Prototype Model

CAE/Virtual Testing: Many Iterations
- Mass Production Tools

Success is based on confidence in predictive CAE methods

Honda R&D Americas, Inc. November 2014
2014 Acura MDX
Midsize luxury SUV

CRASHWORTHINESS

- Small overlap front: G
- Moderate overlap front: G
- Side: G
- Roof strength: G
- Head restraints & seats: G

New for 2014

25% Overlap 64 km/h (40 mph)

Barrier misses main structural members

Occupant Injury Measurements

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IIHS Test video shows what happens to the structure and occupant during this test.
Engineering Analysis Tools

Current tools are great for engineers and CAE experts to analyze model, fix issues and tell a good story of what’s happening to other engineers.

To non-CAE experts these results look “made up”
Virtual Development Goals

- Ultimate goal is to accurately predict the physical test results with a virtual model

- Virtual results need to look like the real world results
In 6 months of working with 3DXCITE we realized a dream of going from this …
To this…
Simulation Postprocessor

and from this ...
To this...
Now we can render scenes that match the test videos by reading the simulation results directly and rendering in 2 days. Previously took experts about 6 weeks.
We can also interactively isolate parts or assemblies that are important to describing and analyzing the event.
Familiar Features

Part groups are imported from crash model or created in Real Impact module.

It’s important to retain familiar post-processor features (changing state, part groups). Parts can be hidden or made transparent to view important areas of the model.
REALIMPACT

- Import LS-DYNA simulation results into DELTAGEN
- Render results in real-time
- Render video off-line

Development theme: push-button simplicity
  - for engineers
Challenges (import)

- No easy path from LS-DYNA to DELTAGEN
  - Solution: custom developed importer
- Structural data is different than CAD
  - solids (fuel, wheels, …)
Challenges (complexity)

- Large, time-varying datasets
  - 1 crash simulation equivalent to 100 vehicles (1 billion triangles)
  - Deformations at 1ms intervals
  - Add data for rendering

Additional data: Surface normals, Texture Coordinates, textures
Solutions: real-time

- Load select simulation states – on demand
- Part groups (metadata from LS-DYNA)
Solutions: off-line

- Custom batch render panel
  - Load, render, and then unload simulation states
  - Clean memory footprint
- Scalable rendering
  - User base typically has High Performance Computing (HPC)
Challenges (on-board cameras)

Solution: part locators

- Link locators to simulation parts
- Use DELTAGEN Logic Network Editor (LNE) to connect locators to other objects (lights, cameras, ..)
Novel Views

- Mix engineering discipline with artistic creativity
- Lead to new and innovative ways to view data
- We’re just getting started…..
- For implementation details, visit our demo area
Benefits of Realistic Visualization

Why do we need to do this?

- This realistic view gives a much better perspective for both experts and non-experts
- Realistic lighting, shading, reflections and textures makes smaller deformations and material fractures stand out and easier to see
- Real Impact can be used to make movies for marketing and sales events while the interactive part can be used to explain technical detail
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- Q & A..