Virtual Strain Gauge Correlation of Structural Components

Presented by: Marc Bastarache
October 6th, 2016
Tower International
Intro to Tower International - Products

Body Structures

Chassis Structures

Energy & Other
Intro to Tower International - Customers

North America
Ford
Chrysler
Nissan
Toyota

Europe
Volkswagen
Volvo
Daimler
Fiat
BMW

China
Cherry

Brazil
Volkswagen
Fiat
Honda
Intro to Tower International – CAE Capabilities

- **Linear Structural**
  - Static Stress
  - Inertia Relief
  - Static Stiffness

- **Non-linear Structural**
  - Non-linear Static Stress

- **NVH**
  - Modal
  - Dynamic Stiffness
  - Frequency Response

- **Durability Analysis**
  - Quasi Static Fatigue
  - Vibration Fatigue

- **Kinematics**
  - Suspension Kinematics

- **Crashworthiness**
  - Front Impact
  - Rear Impact
  - Side Impact
  - Roof Impact
  - Front/Rear Post Impact

- **Optimization**
  - Design Sensitivity
  - Topology

- **Process Simulation**
  - Stamping
  - Extrusion
  - Hydro-Forming
  - Bushing Push In/Out
  - Welding
  - Bolt Clamping
  - Die Press Operation
**Challenge Background**

- **Automotive System Lab Testing**
  - Uses data collected from a prototype vehicle that is driven around the customer’s proving ground (PG)
    - Collected data
      - Loads
      - Strains
      - Acceleration
      - Displacement
    - Calculated data
      - Uses dynamics software to calculate loads at certain points
  - The proving ground data is edited to reduce test time
    - Time constraints
    - Budget constraints
  - Tests for large systems use lots of strain channels to help tune the large system for testing
A component that is part of a short wheelbase (SWB) vehicle variant experienced issues using strain gauges to tune the frame for lab testing.

It was observed that the SWB component did not have a strain gauge in a location that was critical for correctly tuning the lab test.

A similar vehicle variant, the long wheelbase (LWB) was run on the same proving ground and contained a strain gauge in the SWB’s critical location.

**The Challenge**

- Can nCode DesignLife’s virtual strain gauge (VSG) tool be used to create a correlation between the SWB and LWB component’s strains?

- Can the virtual strain generated for the SWB component be used to create an accurate test?
Does the LWB component’s proving ground strain correlate well to the VSG strain?

- **LWB Proving Ground**
  - Range: 996.3 με

- **LWB Virtual Strain Gauge**
  - Range: 721.9 με

- **YES!** With a strain ratio PG/VSG = 996.3/721.9 = 138%
Calculating the SWB Component’s Equivalent Proving Ground Strain

**SWB Virtual Strain Gauge**

Range: 646.1 με

- And apply the strain ratio of 138% between LWB PG strain and VSG strain...

**SWB Adjusted Virtual Strain Gauge**

Range: 891.5 με
Conclusion

- Using nCode DesignLife’s virtual strain gauge tool, Tower was able to gain an understanding of the strain that SWB component should have seen on the proving ground in the critical location.

- Using the adjusted SWB strain we were able to tune the system test correctly and run without the issues that were observed before strain could be correctly tuned.
Thank You!