Automating Vehicle Aerodynamics Simulations for Different Height Configurations

Case study - DOME CO., LTD.

Visual Basic (VB) Interface automates the evaluation of alternative vehicle height configurations

Automatic Adjustment of Simulation Vehicle Heights

Ground vehicle wind tunnel tests often evaluate vehicle aerodynamics for different vehicle height configurations. CFD simulations for such wind tunnel tests require separate computer models for each height configuration.
To simplify this process, DOME used a VB Interface (macro using Windows' COM interface) that automatically makes all the changes to the computer model to properly simulate the height adjustments. It enables steady-state simulations for different height configurations. The VB Interface can also be used for transient simulations where the vehicle height configuration is continuously changing. Vehicle height is adjusted by mesh deformation using the moving element function in SC/Tetra.

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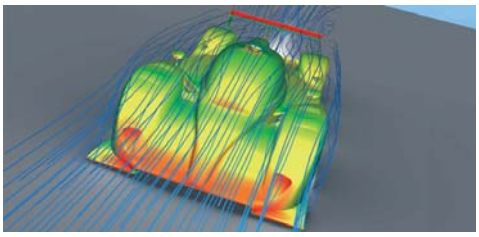
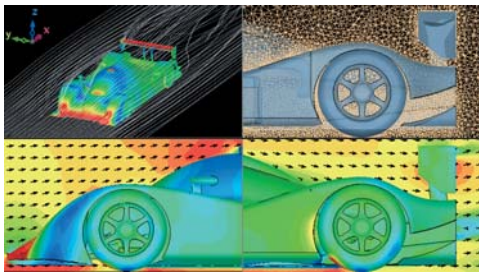


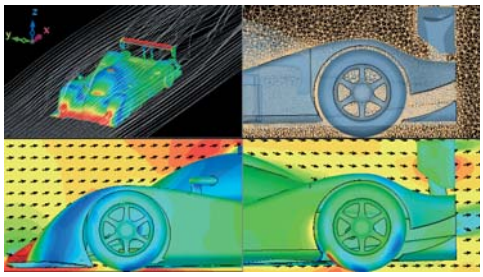
Simulation Results

Steady-state analyses were conducted using the automated VB Interface for vehicle height adjustment. The reference height was 50mm at the front of the vehicle and 50mm at the rear. The results reveal the changes in surface pressure and airflow around the vehicle for different vehicle height configurations. A significant change was predicted for the surface pressure around the front under panel.

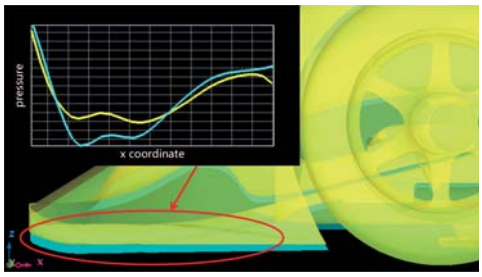
Aerodynamic characteristics at different vehicle heights



Front vehicle height ±0 (mm)
Rear vehicle height ±0 (mm)



Front vehicle height -10 (mm)
Rear vehicle height +30 (mm)



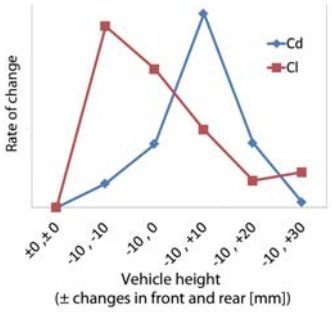
Pressure at front (under)

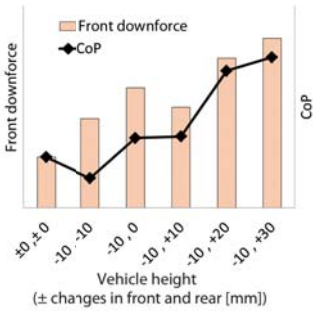
Changes in Aerodynamic Characteristics

Comparison of Downforce

The simulation results were analyzed to evaluate the relationships of vehicle aerodynamic performance at different vehicle height configuration. The graphs using reference heights are shown on the right. The results show that the front downforce increases as the front vehicle height decreases, relative to the rear height while the proportion of downforce at the front (CoP*) increases.

* Center of Pressure





Customer Comments

We used SC/Tetra and its VB Interface to automate the changes to the computer models used to simulate the effects of vehicle height adjustments. The computer simulations represented the height configurations tested in the wind tunnel. Using the VB Interface for transient simulations enabled us to successfully evaluate aerodynamics during vehicle acceleration and deceleration.