EVALUATING VISIBLE PERMANENT DEFORMATION USING THE IMPROVED RENDERING TOOL IN META

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ABSTRACT –
The automobile industry continuously works to shorten the lead time during product development. One way of doing this is by using CAE analysis as a tool for evaluating different design proposals. The use of CAE analysis during the development process is becoming increasingly important since prototype build and physical verification of cars is both expensive and time consuming. The evaluation of a “no visible permanent deformation” requirement is often hard to perform in the CAE post-processing tool but easier to evaluate in the real world after a physical test. The light reflections from the surface needs to be examined in great detail by the human eye from different angles. Using the new improved display mode to visualize models photo-realistically rendered in META helps the CAE engineer to evaluate the simulation results in a similar way as the physical test results are evaluated. An example is shown from the early development of the new Volvo XC60.

1. INTRODUCTION

The automobile industry continuously works to shorten the lead time during product development. One way of doing this is by using CAE analysis as a tool for evaluating different design proposals. The use of CAE analysis during the development process is becoming increasingly important since prototype build and physical verification of cars is both expensive and time consuming.

2. VISIBLE DEFORMATIONS

At the Craftsmanship & Durability Centre at Volvo Cars the requirement for some load cases states that no visible permanent deformation is allowed.

The load case is typically a pressure device that is pushed on different exterior and interior points on the car with a specified load level, see Figure 1.

Figure 1 – Example of pressure device.

After unloading the visible permanent deformation is evaluated by the test engineer by visual inspection from different angles and with different lighting.

3. META RENDERING MODE

In version 17.1.0 a new rendering view mode is implemented in BETA CAE System post-processing software META. The new display mode visualizes models photo-realistically and is easily accessible from a new button in the toolbar, see Figure 2.

To apply different rendering material settings to different parts in the model, the View → Rendering Materials function is used. There are some predefined materials in the database and it is possible to link the material number used in the analysis to a specific material rendering setting, see Figure 3.

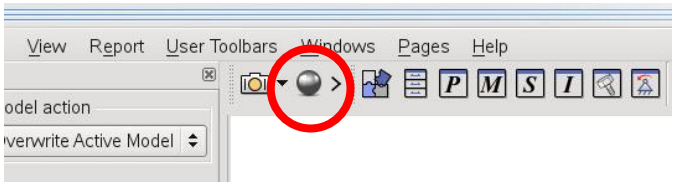

Figure 2 – Render view mode button.

The difference in visualization of the model in the new render view mode and in the normal view mode is shown in Figure 4 and Figure 5. In Figure 5 a zoom in view on the design feature line on the fender is shown, the mesh can be seen in the picture to the left but is smoothed out and looks a lot more realistic when using the render mode. The new render view mode is also applicable for deformed geometry.

In a tested pre-version of Meta it is now possible to have 4 different light sources allowing the light reflections from the surface of interest to be studied in great detail, see Figure 6. It is also possible to write scripts so that the light moves around the test object.

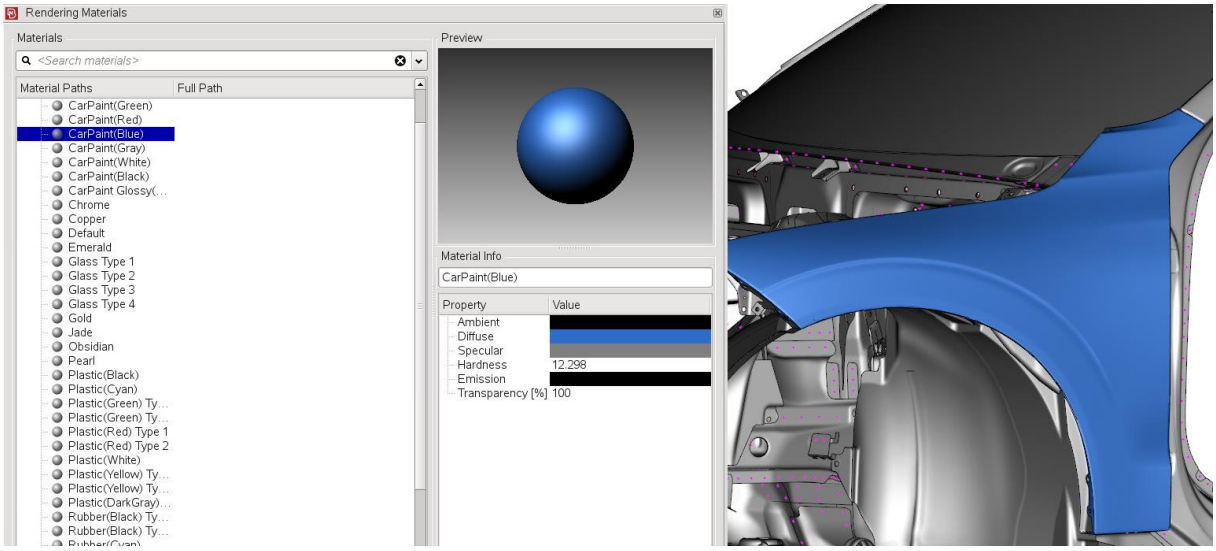

Figure 3 – Rendering material library with predefined material settings.

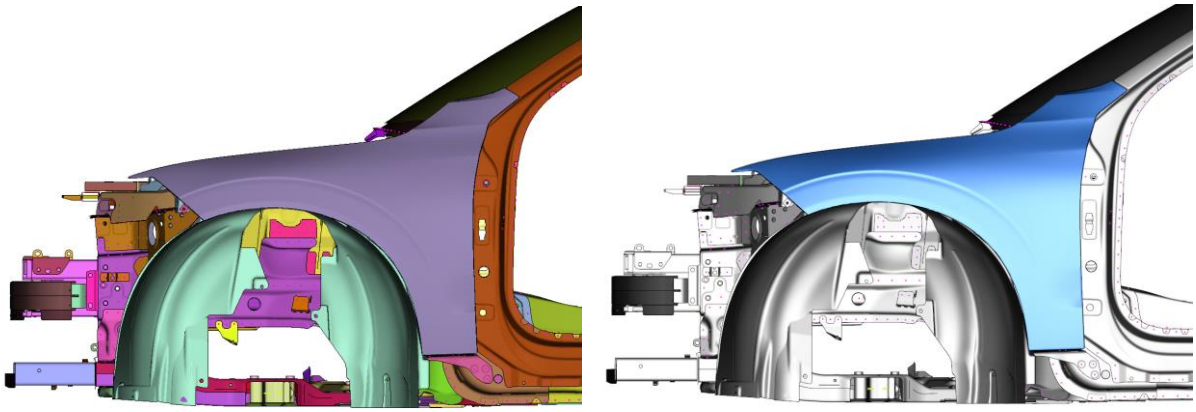
Figure 4 – Left: Normal view mode. Right: Render view mode.

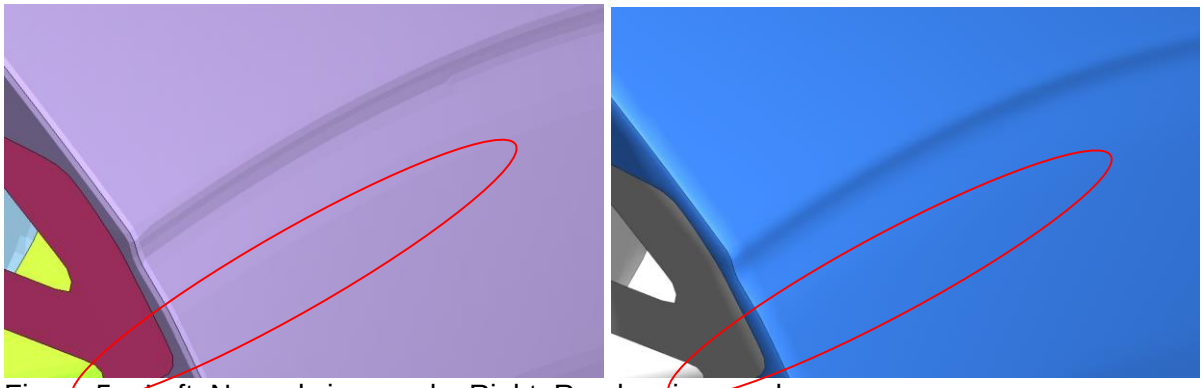
Figure 5 – Left: Normal view mode. Right: Render view mode.

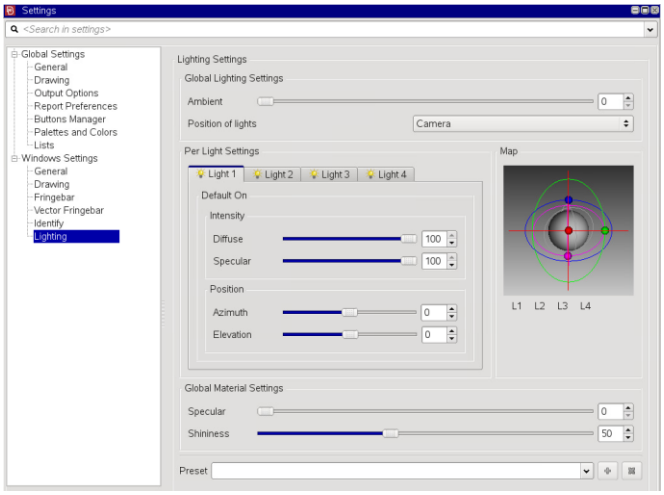

Figure 6 – New lighting settings.

4. EXAMPLE OF RESULTS EVALUATION

An example from the early development of the new Volvo XC60 showing a results evaluation using Meta render view mode is shown in Figure 7. The current method of evaluating permanent visible deformation in CAE is based on displacement contour plots, see the left picture in Figure 7. At displacements above a certain value the results are judged as NOK but it is actually not an evaluation of the visibility of the deformation, the results can be misleading, as shown in Figure 7. The area with judged visible permanent deformation is not the same using the old method of evaluating results compared to using the new render view mode. Also when the conclusion is correct using the old method the render view mode will present a more realistic visualization of the problem to convince the design engineer and project managers that an improvement of the design is needed.

The analysed geometry in the shown example has not been tested physically since it has been improved before final verification testing. Therefore correlation between CAE and testing has not been performed for this specific load case. There was no visible permanent deformation in the final verification testing.

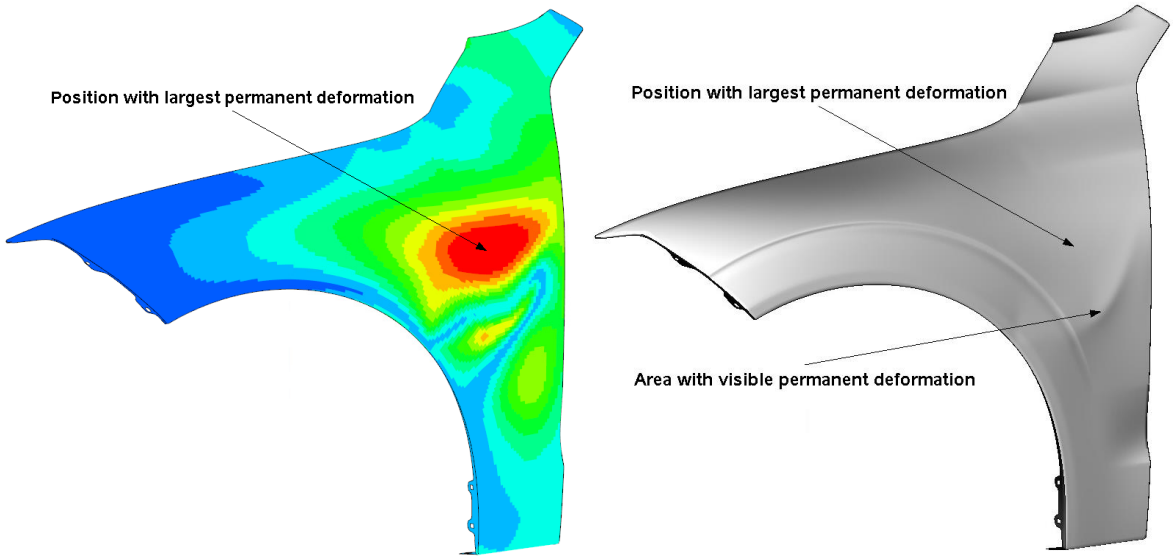

Figure 7 – Left: Current evaluation using contour plot. Right: Evaluation using Meta render view mode.

5. CONCLUSIONS

Using the new improved display mode to visualize models photo-realistically rendered in META helps the CAE engineer to evaluate the simulation results in a similar way as the physical test results are evaluated. This will enable a reduction in the development lead time since more decisions can be made based on CAE results.