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Set up of a RadTherm case in ANSA

Introduction

In recent years thermal management has an increased role in the automotive industry due to its significant effect on the design of reliable mechanical components and improved systems related to human comfort. This work presents a basic scenario of heating an exhaust system of a car and shows the impact on the temperature distribution of the heat shields and the underbody. The model has been meshed and set up in ANSA and solved in RadTherm.

Model build-up

ANSA offers a direct interface to RadTherm and for that reason there is an option in its launcher to start with RadTherm pre-defined settings and the appropriate quality criteria. CAD data can be imported and handled effectively and the user can perform geometry clean up using the advanced capabilities of ANSA (Figure 1)

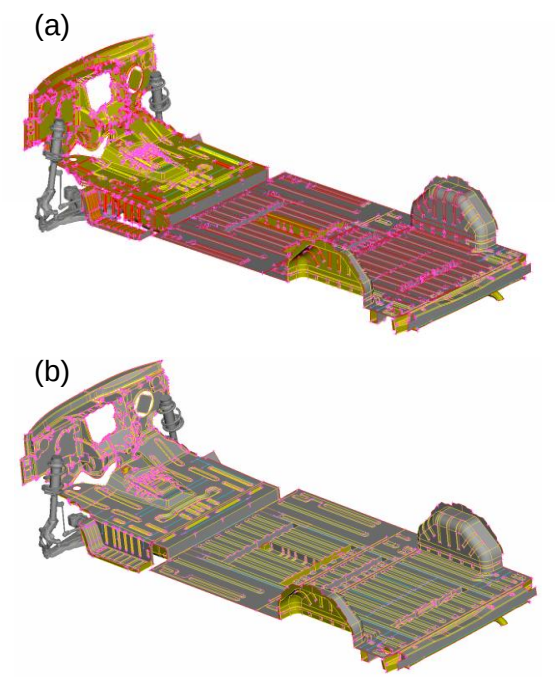


Figure 1: (a) initial – (b) cleaned up geometry

The clean underbody and exhaust geometry of the model have been meshed using the Batch Mesh functionality of ANSA (Figure 2a) that ensures full automation and consistency. For more complex geometries, similar to the front suspension assembly which is not crucial for the thermal simulation, a surface wrapping approach has been followed to extract a watertight mesh of the outer exposed surfaces (Figure 2b). The Merge of the two assemblies results in a complete model (of approximately 150000 elements) (Figure 2c) which passes all RadTherm's quality criteria and checks.

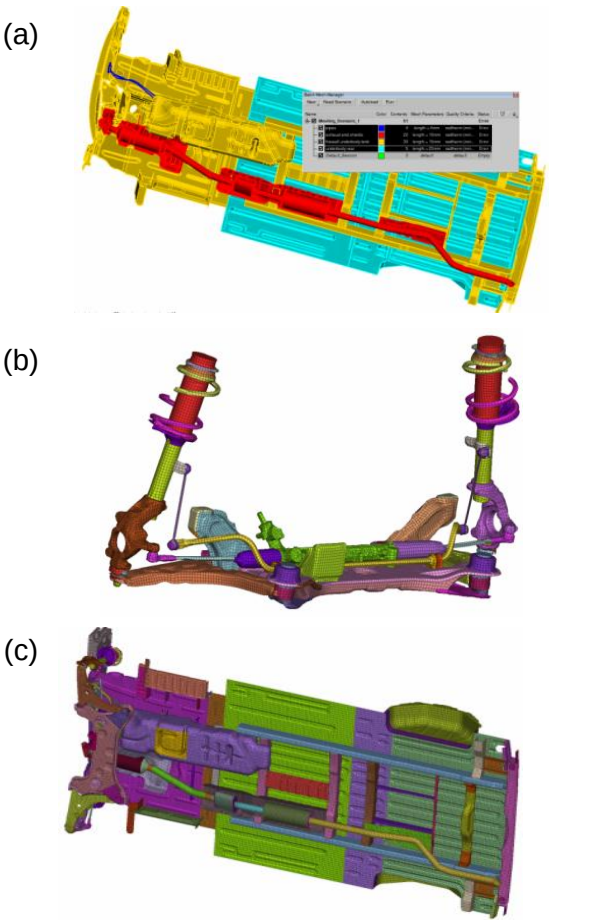
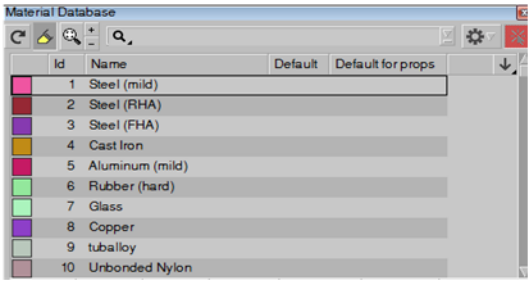


Figure 2: (a) Batch Mesh – (b) surface wrapping – (c) total surface mesh

Case set up

Apart from creating a high quality mesh in ANSA, the user can also take advantage of the enhanced capabilities of the software to support various solver settings such as the definition of the material type and the thickness of each part (Figure 3 a,b).

(a)



(b)

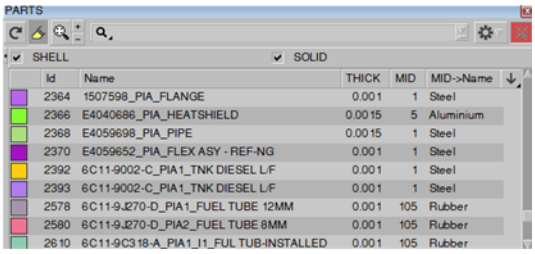
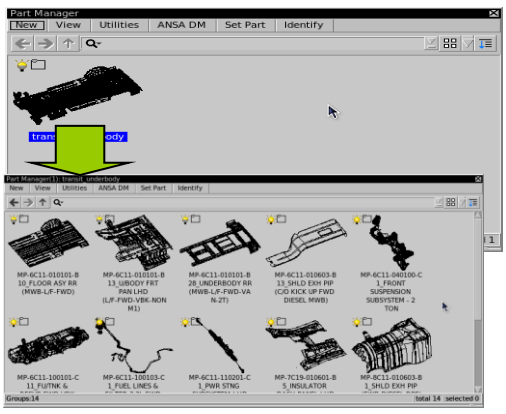


Figure 3: (a) Material list of RadTherm in ANSA - (b) Parts list in ANSA

ANSA also offers model management capabilities by outputting the ANSA Groups in Part Manager as Assemblies in RadTherm (Figure 4a). Moreover the user can assign transient temperature curves to different parts (Figure 4b) and also can define various solution parameters, such as the start time, the duration of the run, and the step size. Additionally the convergence criteria of the simulation are also defined in ANSA. The final model is output directly in RadTherm TDF format.

(a)



(b)

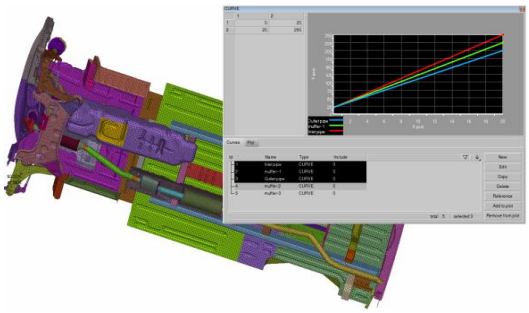
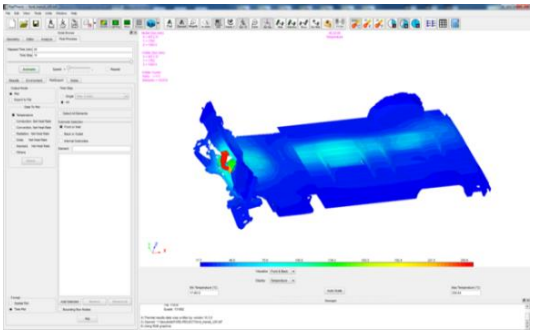


Figure 4: (a) Model handling - (b) Creation of curves in ANSA

RadTherm results

Indicative results of temperature distribution are shown in Figure 5 (a,b). The presence of heat shields can reduce the temperature on car's underbody, allowing for the construction of thinner parts while also creating a positive effect on the human comfort levels inside the cabin.

(a)



(b)

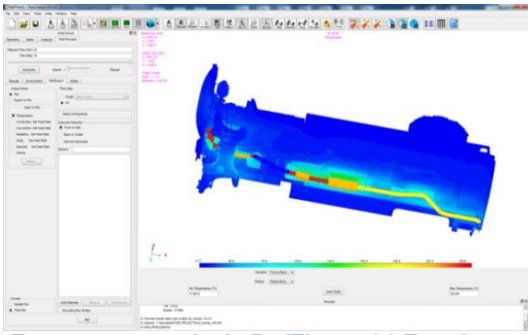


Figure 5: Temperature results in RadTherm: (a) Top view – (b) Bottom view

Conclusions

ANSA can provide high quality and effective pre-processing for RadTherm through the available CAD functionality to build-up a model and the automated generation of high quality mesh which respects RadTherm's quality criteria.

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