Simulation analysis of terminal connector redesign

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1 Introduction

The goal of my thesis was to examine the new plastic terminal trough simulations for a performance focused 48V battery system, which is a cost efficient version of the normal battery. During the development process several load cases were needed to be simulated and validate its results regarding the used standards represented in Figure 1.

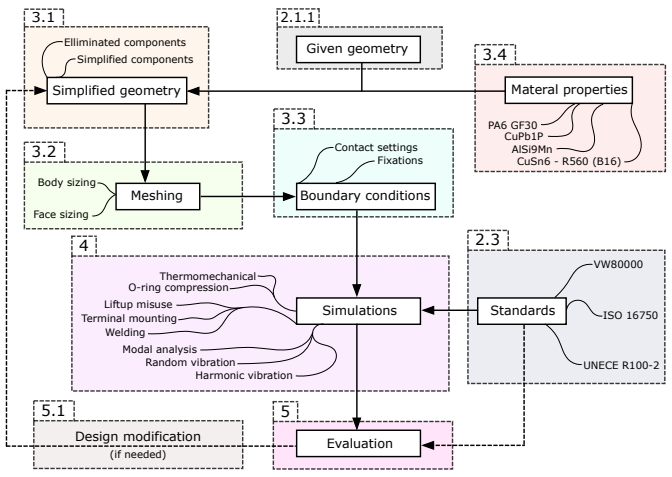

Figure 1: Thesis workflow with every simulation named

2 Pre-process

During pre-process my main task was to simplify the given assembly in a way that represents the original problem yet require less computational power as a result of reduced nodes needed. Many inner parts of the assembly were simplyfied as Figure 2 shows and replaced by an appropriate contact setting based on the literature research.

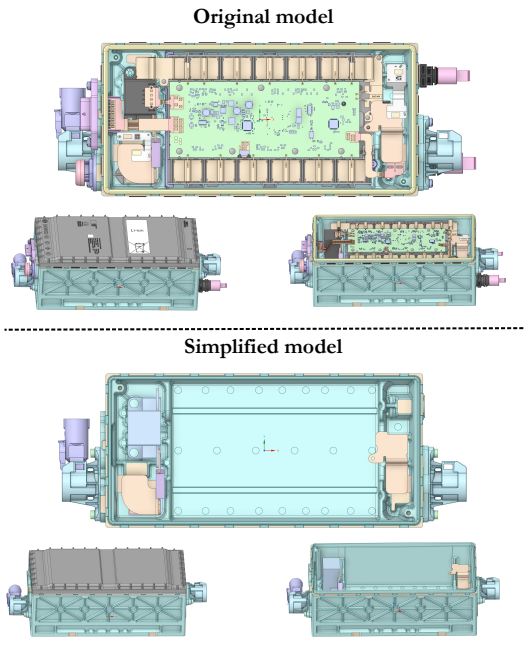

Figure 2: Simplyied geometry comparison to the original

3 Results

The thermomechanical simulation showed that the materials used in the assembly due to their different thermal expansion do not cause the sealing to lose function on the possible temperature range defined in the standards. During the O-ring compression simulation, I examined the effect of the internal ribbing of the terminal against the radial forces occurring after installation which helped clarifying the results. I also simulated different load cases occuring during assemble such as welding simulation regarding the tolerance zone as parameter study showed in Figure 3, or occuring during installation and in case of improper use.

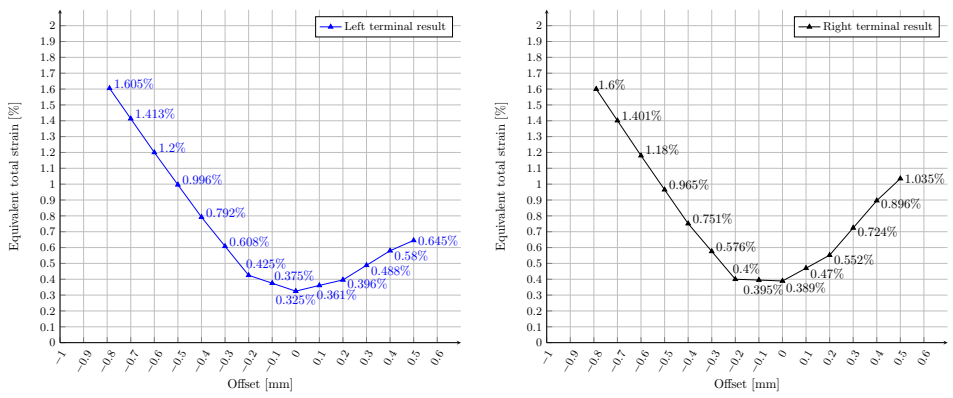

Figure 3: Welding simulation results

Last but not least, I performed modal analysis of the terminal where, in addition to the eigenfrequencies and the mode shapes showed in Figure 4, I examined the response of the structure to random and harmonic external excitation.

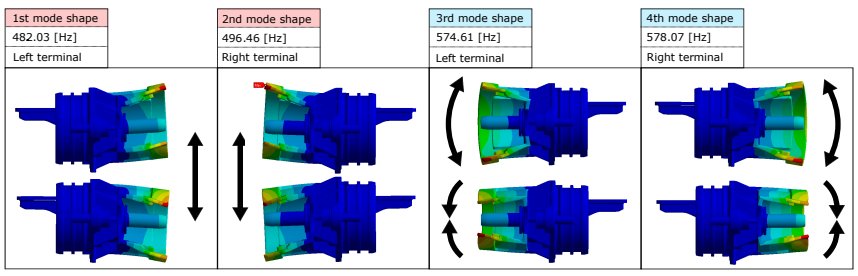

Figure 4: Terminal first eigenfrquencies and mode shapes

4 Summary

To summarize my thesis the 8 different load cases made it difficult to build a default model for later simulations. Default model and it's simplifications were made after studied the contact setting formulations used in FE softwares. As for the evalutaion regarding the simulation results it can be said that the new terminal met the expectations both in comparison with the OEM specifications and in accordance with the standards regarding battery systems.

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