Validation of spot welding simulation in a geometry assurance context at Volvo Trucks

Background
Volvo Trucks is one of the leading truck brands in the world. Volvo makes the only trucks that are proven in all climates and working conditions all over the world. From the humidity of Indonesian rain forests and the thin atmosphere of the Andes, to the bitter –40°C winters of Svalbard, the aggressive and corrosive environments of South American salt deserts and the scorching heat of Saharan quarries. Consequently, setting high demands of every ingoing part. World citizenship, with its vast customer interface, is what fuels Volvo Trucks’ innovations. We listen, we learn and we apply our passion for engineering to making professional life easier for our customers.

This Master thesis a joint venture between Volvo Group Trucks Technology, Volvo Group Trucks Operations and Chalmers University of Technology. So besides having analytical and social skills, self-driven and motivated students are also required in order to progress in a multidisciplinary thesis like this one.

At Volvo GTT the Global Cab Platform group at the department of Cab Technology develops methods and processes to support all phases of the Cab geometry development. We both run research projects and are involved in several besides delivering in product realization projects and programs.

At Chalmers, the geometry assurance research group at the Department of Industrial and Materials Science, division Product Development is a large research group dealing with geometry assurance and robust design. Most of the work is done in close cooperation with industrial partners.

Problem Statement
In today’s manufacturing industry to secure high quality, virtual tools and methods are getting increasingly important to ensure robust solutions as early as possible in the product realization process. Among those tools, RD&T, a computer-aided tolerance tool (CAT-tool) can be used to predict the geometric robustness of non-rigid assembly process in truck cabin’s body-in-white. These assemblies are mainly spot welded together. The sequence of the spot welds known to have a huge influence on the geometric results of the produced units. A method to validate the geometrical outcomes of the simulations and real experiments is searched for.

This thesis work should be conducted by one or two students, skilled in simulation software RD&T, FEM Pre-Post processing software such as ANSA, Poly works & CATIA. Background within the spot welding process and quality assurance is meritorious. The students should be able to perform the tasks independently with structured mindset.

The Master thesis will study specific important body in white areas. Combine theoretical welding simulations with today’s method. Analysis done by Geometry simulations and calculations from pre-post processing software. Compare and correlate hardware to software results. Recommend improvement proposal on production process and methods that can improve geometry quality in today’s products.

Tasks
- Literature studies of geometry assurance, welding simulation and the methods developed at Wingquist Laboratory.
- Study the current working procedures used for welding at Volvo Trucks Body-in-White.
- Data collection for non-rigid variation simulations
- Interview the welding experts and geometry engineers to generate validated rules defining weld sequence
- Run simulations with and without generated rules
- Run the physical experiments with the support of the experts
- Compare simulation results and experiments
- Report the conducted task with analysis of the results

Goals
- Validate the welding simulation
- Define technical requirements and limitations

Conduction
This thesis work needs to be conducted by two students. The time period is flexible, but preferable spring 2018, Volvo Truck will be responsible for the computers, office space and potential costs of the thesis.

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