Improving a Complete Vehicle Model for Solidity Simulations

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CEVT is a research and development organization owned by Chinese Geely Automobile. It was founded in 2013 as a Geely development center in Sweden. The brand Lynk & Co. is being developed solely at CEVT and their first mass produced car is the LYNK & Co 01.

Figure 1: A LYNK & CO 01

In the automotive industry Squeak and Rattle are two important sound based indications of the perceived quality of a vehicle. The road surface transmits vibrations into the body of a vehicle at different frequencies, which induces vibrations into the entire car. Squeak & rattle issues are often related to body stiffness which affects how the car deforms under load. The deformation of a car can be simulated using a complete vehicle simulation which is basically a car driving on a road. It is very important to make sure that the simulation model is a good approximation of the physical model which you are trying to simulate.

The main task in the master thesis project has been to try and understand the simulation model and how close it is to a real model of a car driving on the road. The complete vehicle simulation model consists of two different simulation models working in conjuction, created in Adams and MSC Nastran softwares.

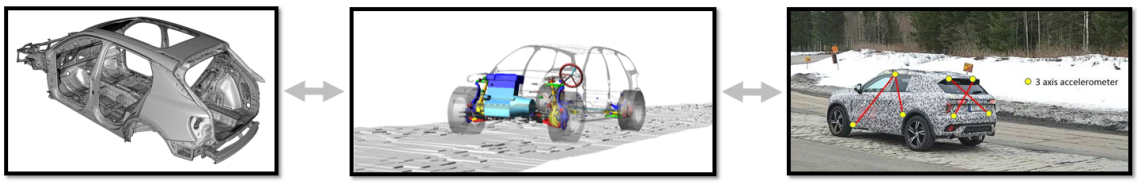

Figure 2: Comparing simulation and test

To understand how good the complete vehicle simulation model is, a test was performed at Hällered Proving Ground in Borås. Accelerometers were glued to the car to measure the deformations in the body closure openings. Also, a wheel force transducer was used to measure forces of the wheel which helped make sure the Adams part of the simulation was good. This gave some very promising results, indicating that the Adams part of the simulation model was a good enough representation of the physical test.

To evaluate the second part of the simulation model proved to be much harder than expected. It proved to be very difficult to distinguish between the contents of the test data obtained from the accelerometers. It included movements both from how the structure deforms during the test but also from all accelerometers moving together at the same time while going over bumps. We were only interested in the movements which came from the deformation in the structure of the car.

To remove the movements from the car going over bumps in the road, different methods were used. One of the methods was to measure how the length of the diagonals in the closure openings varies during the test. It was shown that the diagonal length could vary between -15mm and + 15mm. This length difference was clearly to large and unphysical. If the car would have behaved in this way it would have been permanently damaged. There is a lot to do in the future to try to remove the unwanted movements in the test data. But before moving on any further, the understanding of it needs to be improved.