Using LoCo for Multi Run Simulations

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1 Introduction

For several years now AUDI and DYNAmore (now SCALE) have been working on a new generation of SDM-System called LoadcaseComposer, Short: LoCo. This SDM-System applies several new approaches to Simulation Data Management, such as strict offline capabilities with permanent synchronization of relevant data, consequent and strict version management of all related objects of simulations, novel ontology based approaches for the assembly of components as well as easy customizability and supporting a sustainable process by means of a “continuous integration” approach for frequent upgrades of the entire LoCo deployment.

One of the recent challenges was to enable the user to handle setups for very similar simulations with a minimum of effort and maximum clarity and reusability. In contrary to DOE studies, robustness analyses or optimizations the setup is clearly outlined by regulations such as FMVSS201, ECE-R21 and EuroNCAP testingprocedures. Tools such as LS-OPT could have also been used to setup these kind of simulations, however they lag the ease of use, necessary for users to act on a daily basis as well as the tight integration in an SDM system. Furthermore the nature of these setups is such that a later use in design studies or optimizations as a whole will be of interest.

2 Setup for Multi Run Simulations

2.1 Concepts leading to multi run simulations

LoCo allows process automatization to a huge extent and realizes to some degree a couple of concepts and paradigms known from programming languages.

On the one hand there are includes or components that have to be assembled to complete simulations. They can be compared to data objects of a program. In additions there are the parameters of a setup in LoCo which are rather like variables.

On the other hand there are the attributes in LoCo which to some extend represent conditional statements such as “if”, “than”, “else” and in combination with the RunConfigurations of LoCo these could be interpreted as something similar to the logic of the program or short code fragments.

Having these features, it is already possible to build relatively complex processes for model assemblies, needed to address today’s vehicle development challenges. It is only a logical next step to add the functionality of “loops” to the Simulation Data Management. In the LoCo scope, these loops are implemented in form of “Multi run setups”. By means of a variable (parameter) and corresponding lists the engineer can create loops which will result in the multiple execution (assembly) of a given code fragment (RunConfig) enabling LoCo to reuse all processes and lifecycle management features for each assembly it creates.

The next step already on our road map to complete this analogy will be to provide “multi stage setups” in LoCo. These will allow including one simulation setup within another and could be compared to use “functions” within programming. These will allow engineers to use the complete simulation setup of other departments and disciplines, such as airbag folding or seat assembly, within their own simulation. Referencing to the simulation setup as a whole will allow to dynamically use the already assembled simulation decks of that other department or if necessary run the assembly process, in case there have been parameter changes. Positioning a seat or creating a folded airbag with new parameter sets will be using the process created and approved by the corresponding experts for these topics.

Setup of simulations

The setup for this kind of “Multiple Run Simulations” and the chosen implementation in LoCo will be discussed in this presentation. Illustrated by an example of a repetitive simulation necessary to develop the protective potential in FMVSS201 lower for a Cockpit Structure. It will be shown the change in the development process enabled by the implementation of the MultiRunSimulation feature in LoCo and how this new paradigm greatly increases the efficiency for simulation engineers who have to deal with these kinds of problems.

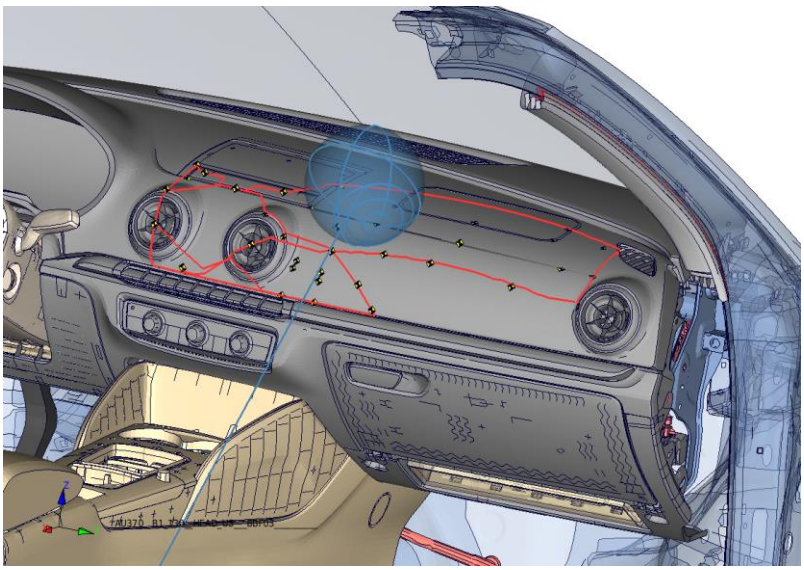

Figure 1: FMVSS201 Area and Impact Points for Head Impact

2.2 Post processing

Besides the obvious problem with multiple job assembly as well as job execution there is also the problem that these kinds of simulations need another kind of post processing where the results of all individual simulations are combined to present a complete status for all subloadcases of the underlying problem.

This requires a different approach in post processing of simulation data which is able to take multiple results of different simulation runs into account and generate an overall summarization as an output.

3 Summary

With this work we intend to show that in the future, SDM will not only be important in order to effectively handle the large amount of simulation variants and related data but also to provide the means to deal with the continuously growing complexity of the underlying problems engineers are facing nowadays.

These are resulting in more and more complex processes and LoCo is the attempt to give the tools to the engineers necessary to deal with the growing complexity of their daily work.

4 Literature

[1] Sandra Brack, Richard Luijkx (AUDI AG), Marko Thiele, Torsten Landschoff, Heiner Müllerschön (DYNAmore GmbH) „Experience Report on the Application of a Process and Data Management System for CAE at AUDI”, NAFEMS – World Congress, Salzburg 2013