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IDENTIFICATION OF SUB-MODELS FOR CRASH SIMULATION

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Virtual prototyping has become an essential component in automotive development processes. Today's goal in vehicle development is to replace physical prototypes by virtual finite element models. This results in increasing requirements on the prediction quality of the simulation models. Detailed representations of joining techniques and realistic modeling of material failure results in high-resolution simulation models, thus the numerical effort is constantly increasing. Therefore new ways have to be found to reduce the numerical effort to an acceptable level. Many commercial finite element codes offer techniques (e.g. sub-modeling, multi-domain techniques, rigid body simulation, macro elements, …) to reduce the simulation time. However nearly all of them need user input to define regions of interest and for example boundary conditions along the cutting sections of the sub-model. This work deals with providing an algorithm to identify these regions automatically by taking into account similarities in input and output data. Local changes in the input data of the simulation model result in different output data. The differences in the output often do not cover the whole simulation model, but they are also localized. Thus, large regions of the simulation model perform similar compared to results out of previous runs, but the influences of local changes in the input data cannot be reliably estimated by hand. As a consequence, all simulations have to be performed on the full crash model. To reduce the numerical effort for the simulations, techniques have to be found, which allow to identify the range of the influence of local changes in input parameters on the simulation results by means of statistical methods. Hence, similarities in different output data (e.g. displacements, energies, stresses, strains, …) can be used to estimate the influence of local changes in range. These results can be used to reliably identify the correct size of the sub-models in an automatic manner without additional user input.

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