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## SCAIMAPPER FOR METAL FORMING APPLICATIONS

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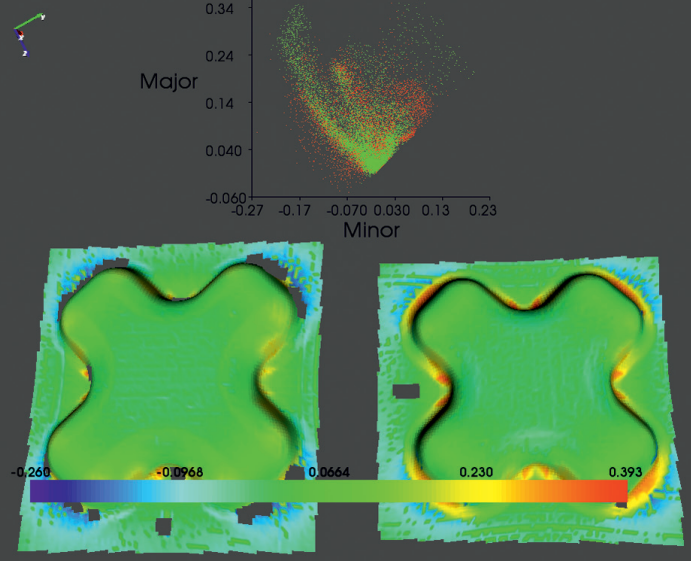
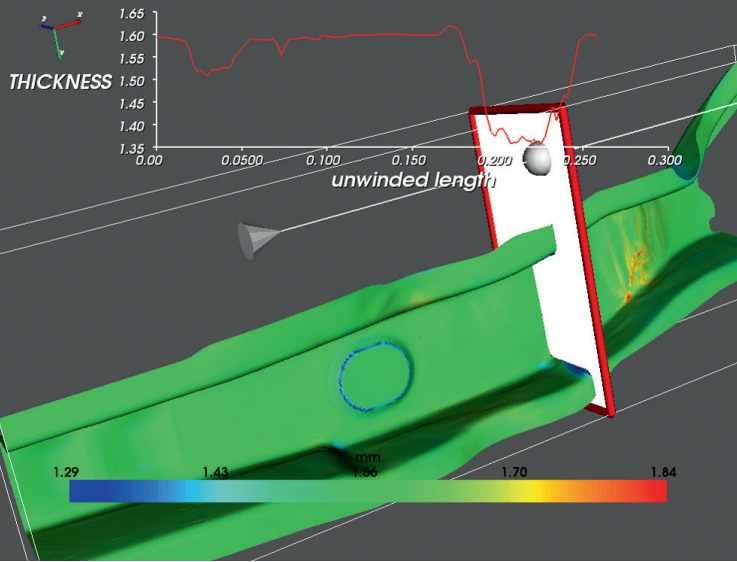
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### Market Demands

During the fabrication of products, important material and process parameters can vary considerably. It is known that they can have a substantial, even critical influence on the quality of the resulting products. Software tools and strategies supporting a thorough analysis of sensitivity, stability and robustness aspects of the final product should take into account results from previous manufacturing steps. Results like local thickness, strains, stresses, or material properties from previous manufacturing simulations should be utilized for the initial states of crash, NVH or structural analysis models. At the same time engineering departments tend to use a set of tools from different software vendors. Thus a central and vendor neutral hub for data transfer is required.

### General Features of SCAIMapper

SCAIMapper allows to check the geometric compliance of two models by calculating the local distances between them. The (automatic) mesh alignment helps to adjust the positions of two models if they are not in a compliant coordinate system. A robust mapping algorithm enables the transfer of various physical quantities (with nodal-, element- or shell-layer based locations) for all standard shell element and mesh types. The mapping works for different integration types as well as for different number of integration points in thickness direction for source and target model. By using a so-called »back-mapping validation« the user can check and estimate the influence of locally incompatible mesh discretizations on the mapping quality. In a similar way the user may compare experimental data (e.g. from forming analysis tools like Atos, Argus, or Autogrid) with simulation results. The SCAIMapper can provide local quantity difference im-



#### 4 Length plot of material thickness

#### 5 Forming limit diagram of two experiments

ages, which then can be used to adjust the parameters of the forming simulation. The SCAIMapper is an easy to use software tool which is dedicated to the data mapping and model comparison tasks. SCAIMapper supports the following solver native formats (read/write/patch):

- LSDyna (.key, .dyn) r/w/\_
- Pam (\_M00-\_M99) r/w/\_
- Abaqus (.inp) r/w/\_
- Pam MAP(.pc, .ps) r/\_/\_
- Radioss (Yxxx) r/w/\_
- Radioss (D00) r/\_/\_
- Nastran (.nas) r/\_/p
- Indeed (.gns): r/\_/\_
- Sysweld (.asc) r/w/p
- Autoform (.af): r/\_/\_
- Argus/Aramis(.txt) r/\_/\_
- Atos (.ply) r/\_/\_
- Autogrid (.dat) r/\_/\_

Further formats on request.

#### Faurecia – Fasten Your Seat Belts

SCAIMapper has been integrated into the worldwide engineering workflow of Faurecia’s business area »automotive seat systems«. If in a manufacturing simulation the local thickness, local stress or strain distribution exceed certain critical values the workflow initiates variations of crash simulations with mapped results for the initial state. These variation studies are used to check the sensitivities of crash behavior to those critical manufacturing results. In many cases the consideration of manufacturing history has shown a significant

impact on the local crash behavior. At Faurecia the SCAIMapper now is used as a central hub for data transfer between manufacturing and crash or NVH calculations. In this role the SCAIMapper helped Faurecia to improve their seat system design during the last years.

#### VW - From Coils to Painted Cars

The Volkswagen AG applies SCAIMapper in various engineering areas. In the project »VIPROF« SCAIMapper enables complex manufacturing process chains. Aim of VIPROF study is to evaluate the influence of the stamping, welding and painting processes on the final product properties. This can be achieved by a virtual validation of the feasibility of the manufacturing processes. SCAIMapper acts as a key technology for VW to realize complex integrated manufacturing workflows.

#### Audi – Lighten Your Stamping Tools

Nowadays layout and construction of new stamping tools is based on long term experience and guidance. However the growing complexity of automotive parts and the increase of production speed necessitate an optimization of the structural layout of tools. The overall weight of the machine (especially of the moving parts) needs to be reduced – while at the same time the deflection due to the stamping forces should be decreased. In that context Audi and its engineering

partners use SCAIMapper to transfer the maximum pressure loads of the effective stamping surface (calculated with Autoform) to a structural optimization environment (TOSCA and Abaqus). The optimization process thus can consider the real loads of the designed stamping processes in its suggestions for improvement.

#### Adjusting Simulation Parameters

In the automobile industry, flat steel products present a wide variety of opportunities for simulation-based adaptation of component geometries. Strict standards of producibility, stability, crash performance and weight call for high-precision CAE methods and models for target-oriented estimates of material performance.

The factors of interest when simulated components are transferred to production in a stamping operation include not only physical variables but also process-based parameters.

For this task, SCAIMapper offers a graphic display of the influence of potential process parameter adjustments across the entire component. For steel manufacturers SCAIMapper is a convenient validation tool in use as part of daily work. With the software tool optimized for these purposes, users can compare a range of simulated and experimental results with another and the results among themselves. Enhancements to SCAIMapper offer employees in stamping, and materials and vehicle developers, a quick-responding graphic display of the effects of changes in method.