

ANALYSIS OF COMPONENT JOINTS IN FINITE-ELEMENT MODELS OF CAR BODIES

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ABSTRACT - A body-in-white of a car in sheet-metal integral design is composed of components connected by suitable joints. Challenge for the body development is to generate a stiff and lightweight body-in-white structure according to the performance specifications. The finite element analysis is the appropriate method to investigate the performance of a given design.

The stiffness of a body-in-white can be rated using results of a modal analysis or a static loading obtained from a finite element model. Crucial for the usability of the produced results and for subsequent computations is the appropriate definition of the joints in number and location. The checking of models for missing or misplaced joints and the redistribution of joints is a time consuming manual process. To simplify this task a method is suggested which reduces the manual effort.

The key of the suggested method is a reduction of the body-in-white to surface elements which are located in contact distance to each other. During the process of reduction, a projection algorithm is used to identify possible contact surfaces in irregular finite element meshes. Results of a finite element analysis with the full structure are needed to find suitable criteria for the quality of the joining technique. Scalar quantities or vector data on nodes or elements produce usable criteria. Typically, from the results of a modal analysis, the relative displacement between the component surfaces or the strain energy in the metal sheets is used.

A rating of the chosen criteria at the connection faces identifies regions with a potential for improvements of the joining technique. The magnitude of the improvement can be estimated by an automated redesign of the joining technique in sensitive regions. The application of the method is presented on recent car configurations of Volkswagen Nutzfahrzeuge.

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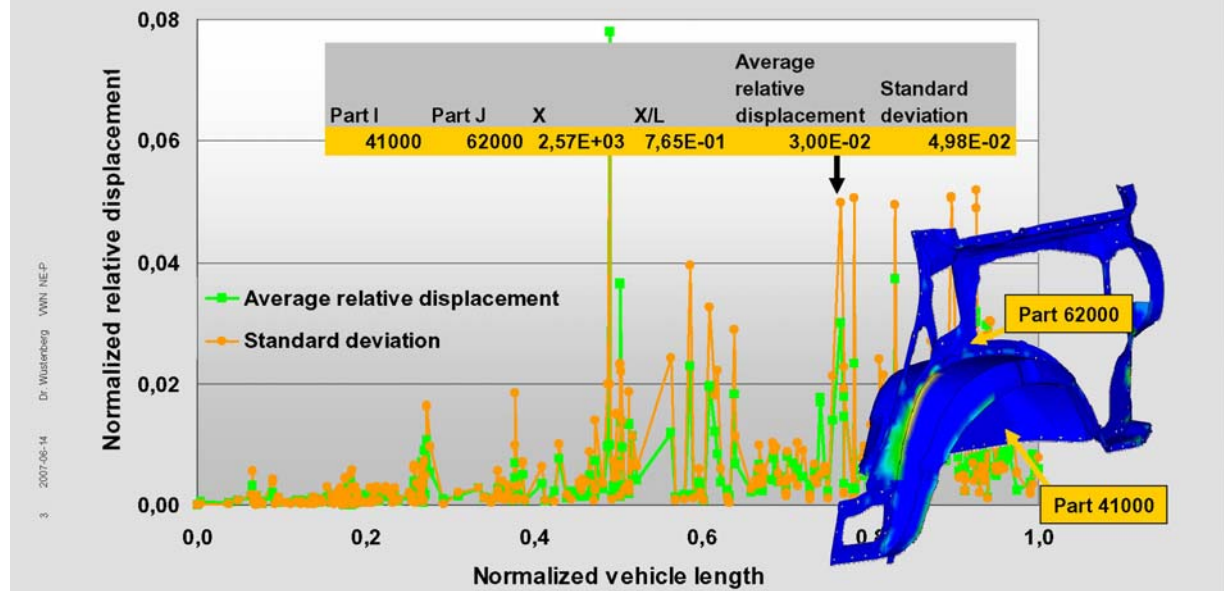
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- Picture 4 starts an avi-animation with a click on the picture
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Connectivity rating in modal analysis

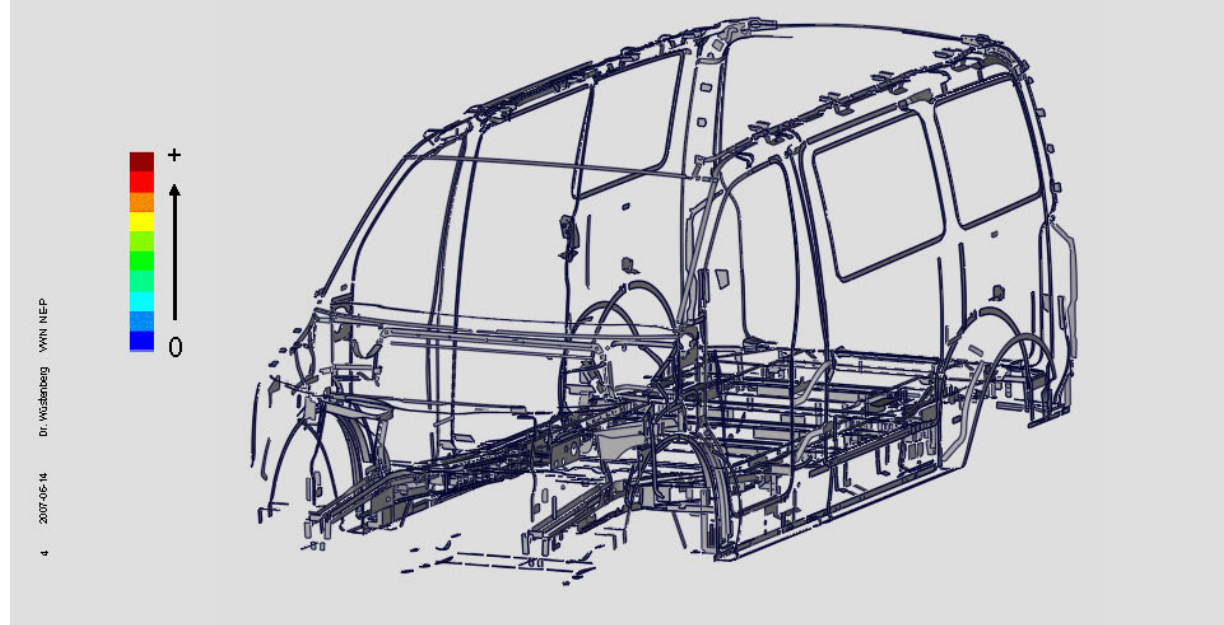
Rating of part connectivity

Statistical analysis of relative displacements



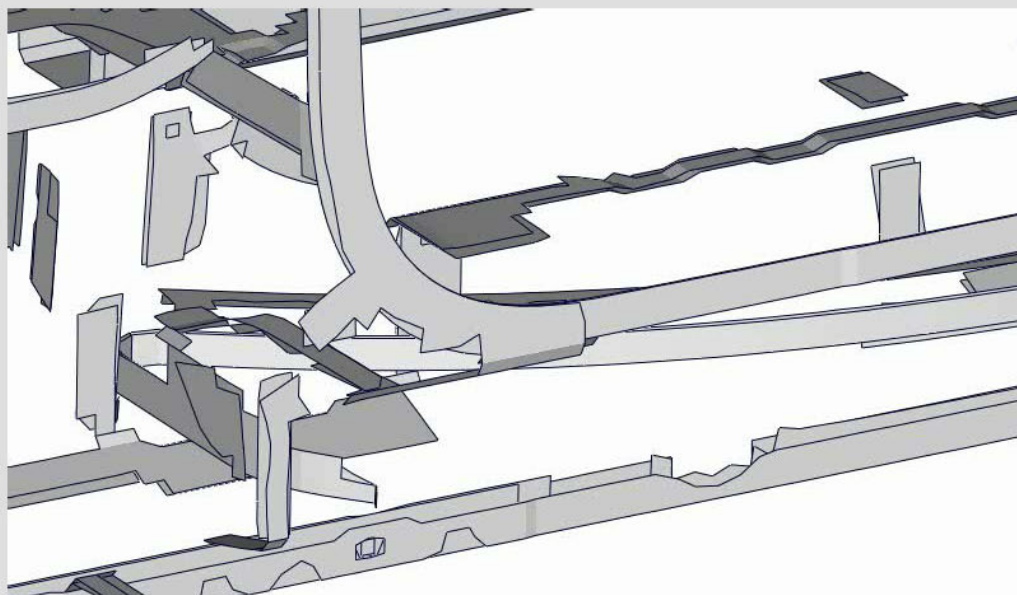
Connectivity rating in modal analysis

Relative displacements in torsion eigenmode



Connectivity rating in modal analysis

B-pillar region



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