

Abstract from FE-DESIGN by Matthias Friedrich (Head of Engineering)

Title of our presentation:

Leading OEMs using TOSCA Structure for cost-effective non-parametric optimization in their SIMULIA/ABAQUS environment.

Abstract of our presentation:

The present presentation will have a focus on the latest release of the optimization program TOSCA Structure 7.0 where several industrial applications with ABAQUS will be shown. The release TOSCA 7.0 has a strong focus on solutions and features for ABAQUS users which will be shown by industrial examples.

TOSCA Structure is a non-parametric optimization program automatically modifying the ABAQUS finite element input deck in each optimization iteration. Some of the big advantages of using TOSCA Structure together with ABAQUS are that it allows the user to include advanced contact modeling, modified elements, material and geometrical non-linearities directly in the optimization. Furthermore, large scale ABAQUS CAE models can be handled efficiently in the optimization by running ABAQUS using efficient execution of parallel processors.

The designs obtained using topology optimization in TOSCA.TOPO is considered as design proposals. These topology optimized designs can often be rather different compared to designs obtained with a trial and error design process or designs obtained upon improvements of existing design.

For topology optimization the following among other examples will be shown:

- Introduction to topology optimization.
- Cast constraints in topology optimization ensuring easy manufacturing of optimized designs.
- Several mass constraints and constitutive laws in design domain.
- Stiffness optimization having constraints on contact pressure.
- Acoustic pressure optimization for ABAQUS models containing structural-acoustic interaction by changing the material distribution in the structural parts.

Shape optimization in TOSCA.SHAPE is mostly used at the end of the designing process. Typically, the objective function is to minimize and avoid stress concentrations for obtaining a uniform stress-distribution. The main concept of the method is to use the positions of the surface nodes as design variables which lead to an easy handling seen from the user when defining the optimization because just a node group (NSET) has to be defined as input for the optimization and no splines have to be defined.

For shape optimization the following among other examples will be shown:

- Introduction to shape optimization.
- Manufacturing constraints in shape optimization.
- Optimization for uniform contact pressure using the contact pressure directly from ABAQUS.
- Optimization using fatigue results where the damage is minimized. The fatigue results for the optimization can be given by a commercial or an in-house fatigue code for ABAQUS.