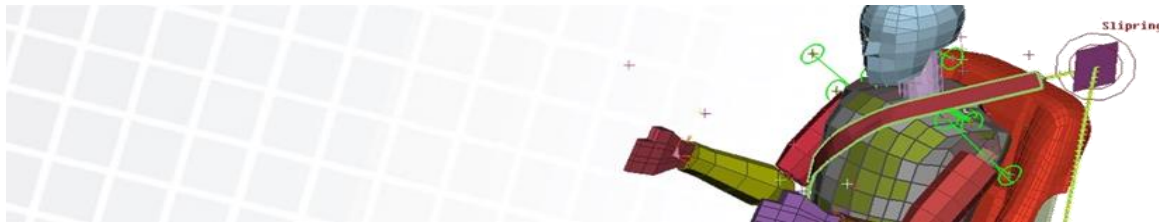# ANSA Model Checks for LS-DYNA

Introduction

One of the most important pre-processing tasks is to ensure the validity of a CAE model before submitting it to the solver for analysis. A good and rich suite of checks reduces engineering errors, increases the confidence in the simulation results, and minimizes the duration of a simulation cycle by eliminating multiple back and forths from the solver to the pre-processor. ANSA meets the demands of the industry by providing a complete library of checks.

Checks Manager

The Checks Manager is the main tool and manages all the various checks required for a specific model set-up. The user has the ability to create templates with all the needed checks and desired ranges for every type of analysis. Templates can be saved, re-used and shared with the rest of the team. This ensures that the model check process can be standardized.
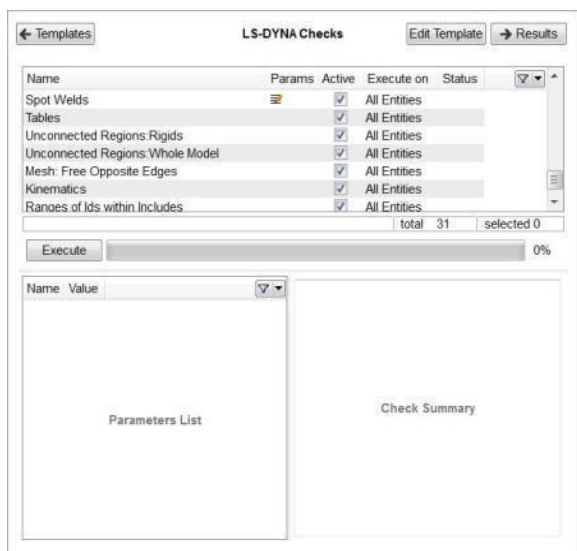
The Checks Manager presents the results of the checks color-coded in groups of per type error based on the category of the error or warning. Tools are provided to automatically fix errors from within the Checks Manager interface.

Some of the major LS-DYNA specific checks that are controlled by the Checks Manager are presented below.

Penetration Check

Penetration detection and fixing is generally a time consuming task. ANSA provides a check that both detects and auto fixes penetrations. The check can be applied both on pure FE mesh and on mesh with the underlying geometry. Intersections and thickness penetrations are detected and listed. Auto-fix tools intelligently move the nodes away from each other without creating any local distortions.

Contacts Checks

The contacts check functionality detects various possible errors of the contact definitions. These are:

- The validity of the SETs defined as master and slave in the contact. Empty sets, sets with free nodes, and nodes used only by segments are flagged by the tool.

- In case of TIED contacts, incorrect definition and definitions with prohibitive distances between the participating entities

are detected. Automatic fixes are available to facilitate the correction of the model.

- Common entities on slave and master areas (SETs) of a contact are identified and listed. Visibility functions can help the user to isolate and work with each identified error.

- Slave nodes of connection should always be attached to a master segment. The Check>Contacts function identifies the errors and previews them on the model.

- The most important contact check is the identification of contact thickness penetration. The tool identifies the violating areas per LS-DYNA requirements and presents them to the user. An automatic fix is available that fixes these penetrations fast and accurately.

Connections Check

ANSA provides the user with very advanced model assembly tools. Thus, powerful checks that validate the connectivity of the model are available. Some of these checks include:

- Areas that are not connected with the rest of the model can be identified.

- Spotwelds in contact with elements which have Nodal rigid Bodies attached are identified. The Automatic fix functionality can offset the contact of the respective spotwelds.

- Spotweld beam elements that deviate from the shell's normal by a user defined angle are identified.

- Spotweld beams with a length greater than a user defined value.

Rigid Bodies

One of the most common checks for a crash model is the rigid body dependency check. ANSA's check identifies and fixes these errors. Any nodes belonging to two or more rigid parts, nodal rigid bodies, or constrained extra nodes are detected and listed. The Auto-fix functionality merges these entities to resolve the conflict. In addition Constraint Nodal Rigid Bodies that are not attached to a structural part can be

identified. Similarly, when an SPC is defined on a rigid body is detected and previewed.
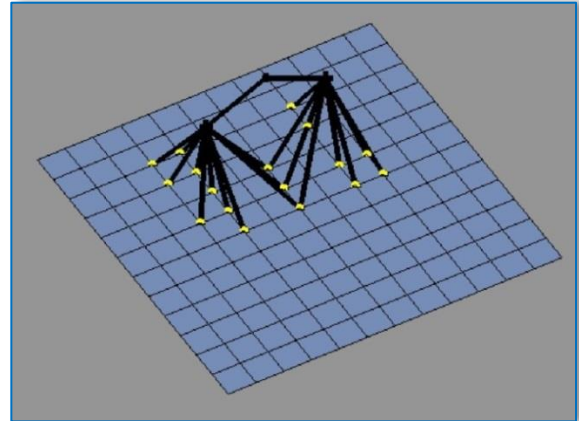
Check Free

The free nodes check identifies nodes that are referenced by only one entity (dependent free nodes) or not referenced by any entity (independent free nodes).

Check Mesh

Multiple checks functionality that checks the quality of the mesh of the model is available. There are visual checks that show the violating elements color-coded per the violating criteria. Additional checks that identify negative volumes, trias on boundaries, or any opposite free edges are also available. Automatic fixes that use advanced meshing algorithms can reconstruct the mesh locally to create the best possible mesh quality

Check Curves

Through the corresponding functionality engineers can identify whether there is any curve that has descending data on X or Y axis. Moreover, END DATA function will check if the END time of a curve agrees with the one set in the CONTROLs card. Also, the user can check the curve according to user defined time value.

Model DATA Check

The Model Data check identifies whether an entity has not been defined properly. The cards of each LS-DYNA keyword are checked for any mistake and detected issues are listed and previewed to the user.

Check DATABASE keywords

DATABASE keywords related checks are also available.

For example, ANSA identifies situations where a DATABASE_CROSS_SECTION is defined but it does not cut through any elements, or when the user has forgotten to define a DATABASE_SECFORC.
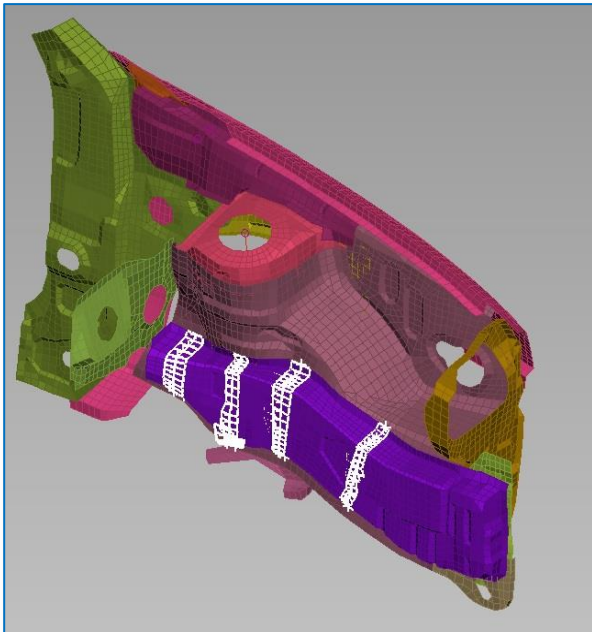

Accelerometer elements that do not reference to a DATABASE_HISTORY are identified and presented to the user.
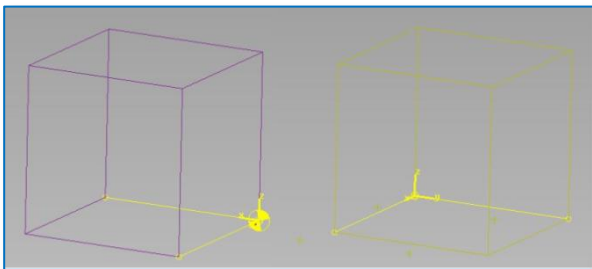
Mass Checks

The Massless check identifies grids with no mass. The massless nodes are listed and highlighted on the model. Mass Scale Ratio check functionality enables engineers to isolate areas that correspond to a specific range of added mass. The user has just to

type the desired range and ANSA isolates and lists the corresponding areas. Moreover, fringe plot of the elements colored according to Additional or Scaled mass over Physical mass is available allowing for the identification of the elements that cause mass scaling.
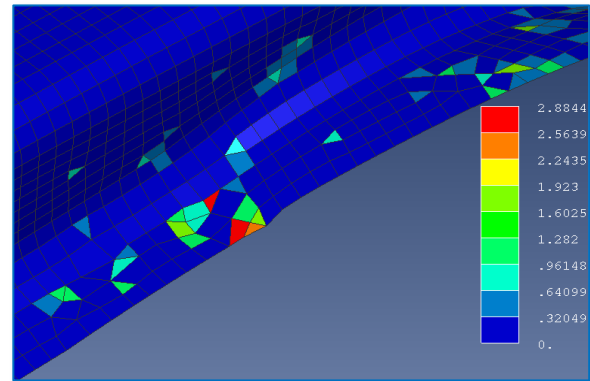
Check Joints

Checking the validity of the Joints without the use of an advanced tool can be a very meticulous and time consuming task. ANSA checks the validity of all the joint definition of LS-DYNA. Any problems such as, misalignments, wrong order, or node pairs are identified and auto fixes are available.

Live checks

Every time a file is imported in ANSA there is a real time check for errors and warnings of the read data. The results of the check are presented in a window notifying the user accordingly. Additionally, ANSA performs certain checks every time a new entity is created. For example, ANSA will not allow the creation of a new SECTION card with negative thickness value.

User defined Checks

There are cases where users have specific custom made tests that would like to run on their models. ANSA provides libraries of functions for the user to develop a Python Script. The scripts can interact with the checks manager in the same way as the hard coded checks do.

Conclusions

Model checking is an important step of the crash model set up process. Successful checks accelerate model development by reducing errors and by reducing -if not eliminating- the multiple exchanges between the solver and the pre-processor. ANSA has a rich suite of checks with modern interface and provides the user with the ability to create his/her own custom checks.

For more information contact

BETA CAE Systems S.A.

Email: ansa@beta-cae.gr

URL: http://www.beta-cae.gr