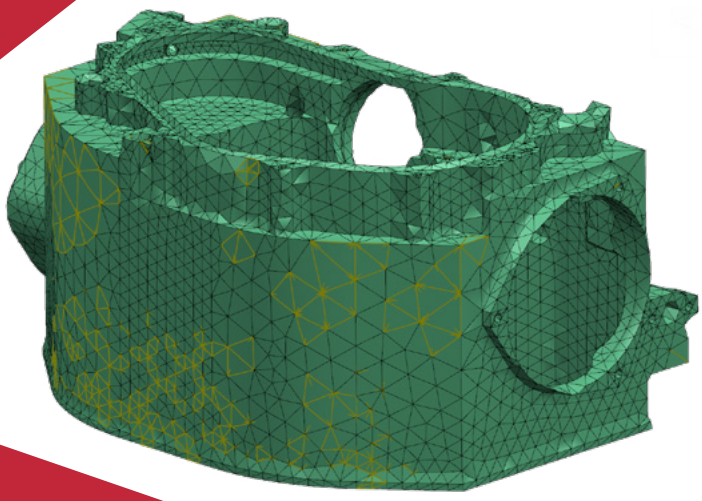
NX 9

WHITEPAPER

Basic Model Checks in NX



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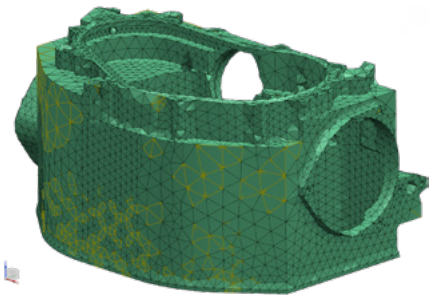

Software:
NX 9 Advanced Simulation

Overview

Model checks are an important part of finite element analysis. They reduce the chance for incorrect results and improve project efficiency by reducing solution errors. Model checks include, but are not limited to, mass/CG checks, physical property/material checks, and checks of element quality, grounding, stiffness, and applied load/reaction force balance. This document explains basic techniques for checking a model at each step of the modeling process in NX.

More information on advanced Nastran model checks such as grounding, free-free modes, and stiffness can be found in the NX Nastran Model Checks white paper.

This whitepaper is part of a series of free Siemens PLM Software training resources provided by ATA. For more whitepapers, tutorials, videos, and macros, visit ATA's PLM Software website: http://www.ata-plmsoftware.com/resources.

Basic Model Checks in NX

Mass Check

Several tools within NX allow users to check a model's mass, CG, and inertias. For CAD geometry, this can be done by using the Measure Bodies command in the modeling application (Figure 1, left). The Measure Bodies tool can be found under Menu → Analysis → Measure Bodies. At the FEM level, use the Solid Properties Check command found under Menu → Information → Advanced

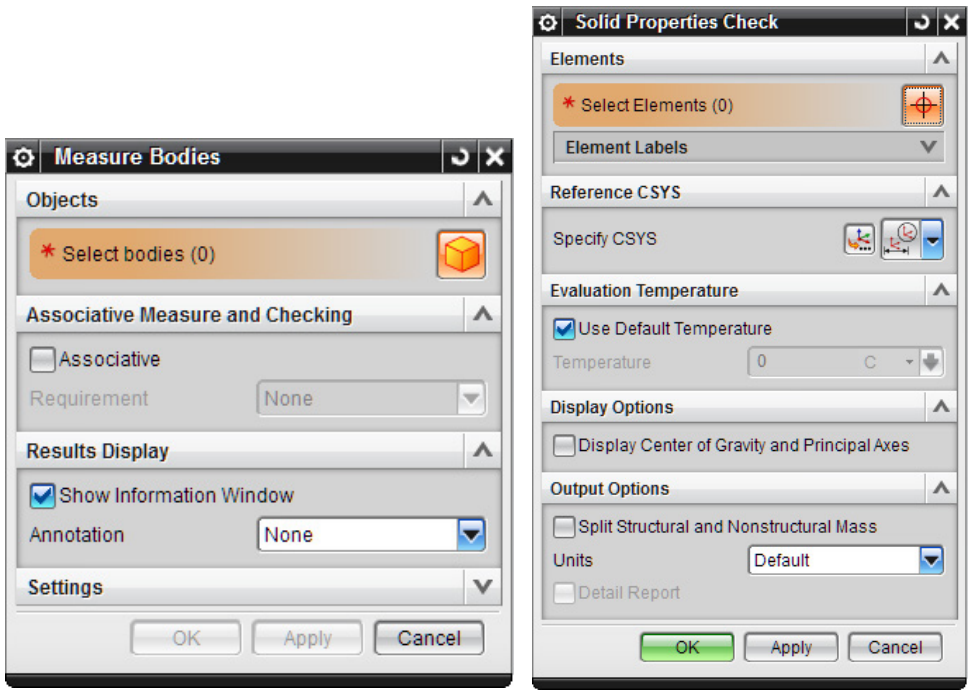

Figure 1: ▶
Measure Bodies and Solid Properties Check dialog boxes for weight checks..

Simulation → Solid Properties Check (Figure 1, right). The Solid Properties Check can check various properties of any number of selected elements, including total length (for 1D elements), total area (2D elements), and total volume, mass, center of gravity, moments, and products of inertia about any desired coordinate system.

Checking Physical and Material Properties

NX has an easy tool for coloring elements based on their physical property, material property, and other qualifications. This tool, which can be used to quickly verify that properties are assigned as desired, can be found under Menu → Preferences → Model Display (Figure 2, left). Additionally, NX allows the user to

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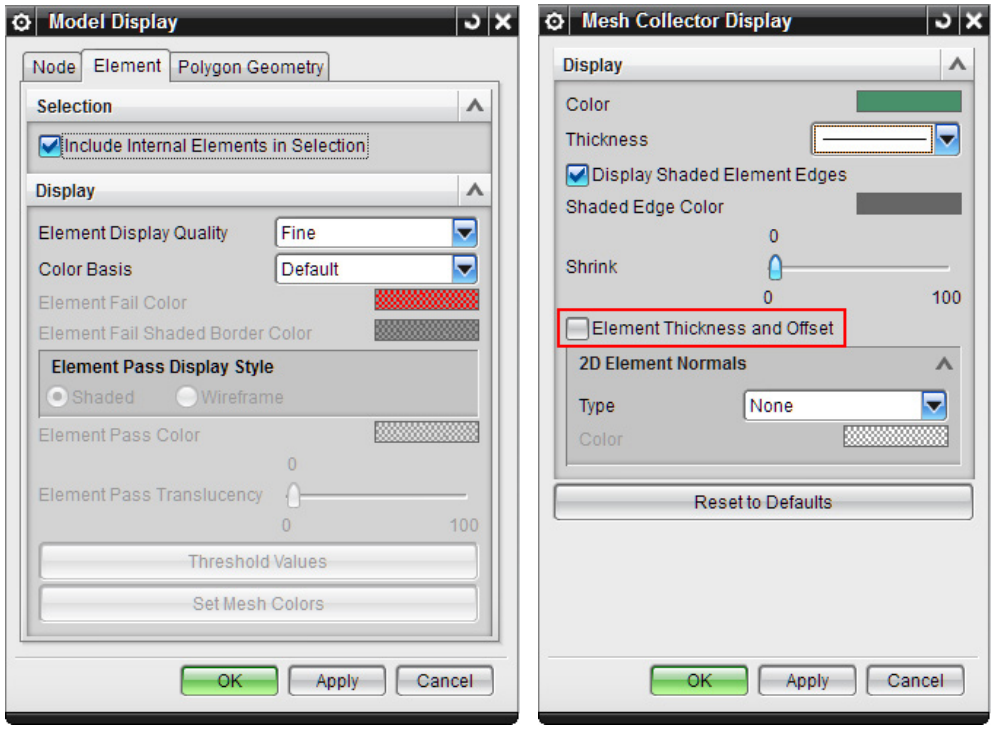

Figure 2: ▶
Model Display and Mesh Collector Display dialog boxes for inertial checks.

toggle on element thicknesses and offsets for verification (red box in Figure 2, right). This tool can be found under Menu → Preferences → Mesh Collector Display (Figure 2, right). Material orientations and element normals can be checked on a mesh-by-mesh level by right-clicking on a mesh and selecting Check → Material orientations or Check → Element normals.

Mesh Quality and Free Edges

During and after meshing there are simple ways to check that the FEM has been made properly and everything is connected as desired. To check the geometrical quality of the mesh, use the Element Quality command in the Checks and Information toolbar (Figure 3). This function identifies any elements that are distorted beyond Nastran's default threshold values.

The Checks and Information toolbar also has tools for displaying unconnected edges. The Element Edge tool will display element free edges with pink lines. Look at each component of your FEM and check that there are no highlighted outlines where a connection is expected. If there are unattached edges, use the Stitch Edge command in the Polygon Geometry toolbar to connect the edges of

Basic Model Checks in NX

the underlying polygons appropriately. If there is no underlying polygon geometry available to stitch, check for Coincident Nodes and Elements using the Duplicate Nodes and Duplicate Elements tools in the Checks and Information toolbar. These tools can be used to combine nodes on separate elements, eliminating the free edge, and they can also be used to delete any coincident nodes or elements that may have gone unnoticed when the FEM was created.

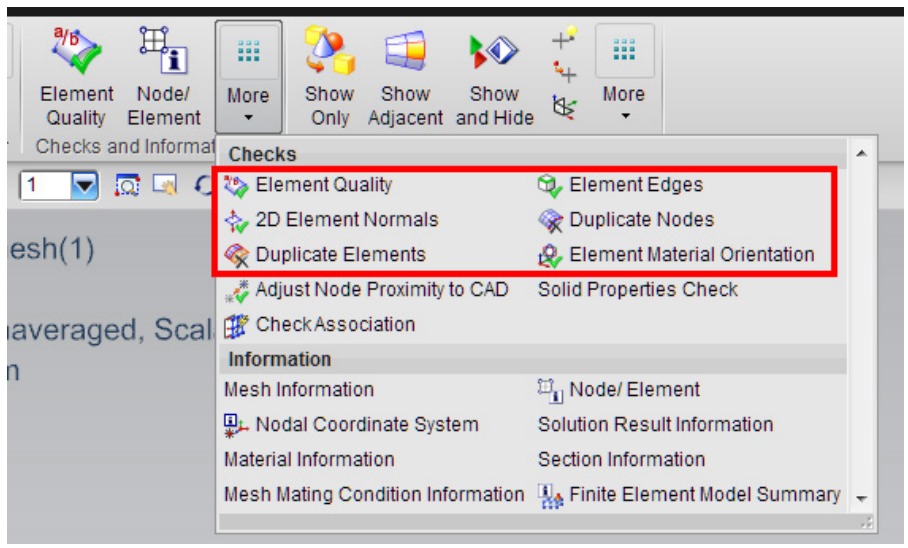

Figure 3: ▶
Red boxes highlight the mesh-quality checks in the Checks and Information toolbar.

Qualitative Assessment of Results

One of the best but most difficult-to-perform checks is a qualitative assessment of results. A good analyst should have an idea of what answer to expect from a simulation prior to looking at results, and the analyst should look at the results to confirm that they are as expected. If they deviate significantly from expectations, then the analyst should determine why. For example, a stress analyst might ask themselves the following questions when looking at the first set of simulation results.

- Do these deformed shapes and amplitudes make physical sense?
- Are there any missing connections that can be seen?
- Are there large discontinuities in the stress results?
- Does the sum of reaction forces equal the sum of applied loads?
- Do the individual reaction forces make sense?

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