Coupling ANSYS Workbench with VisualDOC

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Basic Concepts and Steps

- Regard the ANSYS analysis as a blackbox

- Specify the parameters with ANSYS Workbench

- Call ANSYS from VisualDOC, extract variables from the parameter-set and classify the parameters into input and output files

- Run optimization, ANSYS Workbench will be executed in the batch mode

- Plot design history with concurrent monitors
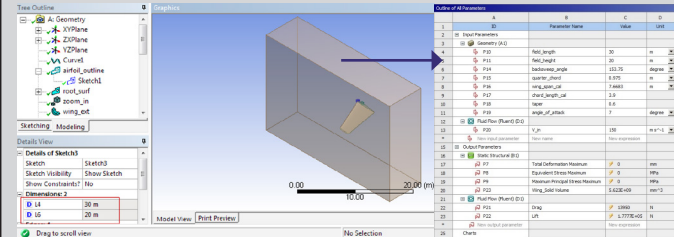
Optimization Settings

- Objective: Maximize lift-to-drag ratio

- Constraints: Stress and deflection

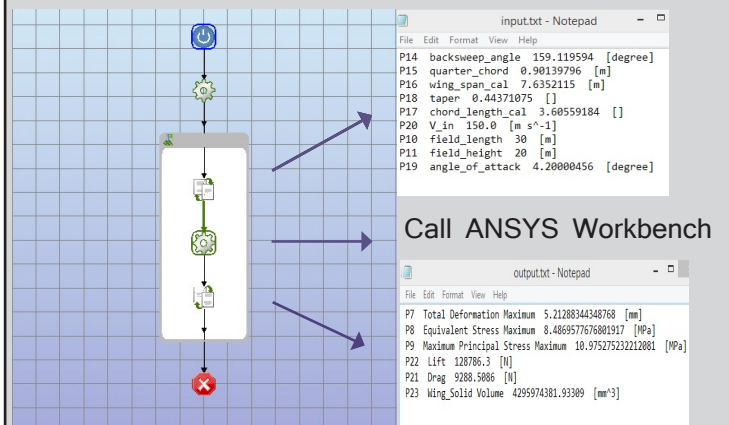- Design variables: Geometrical dimensions

Optimization Result
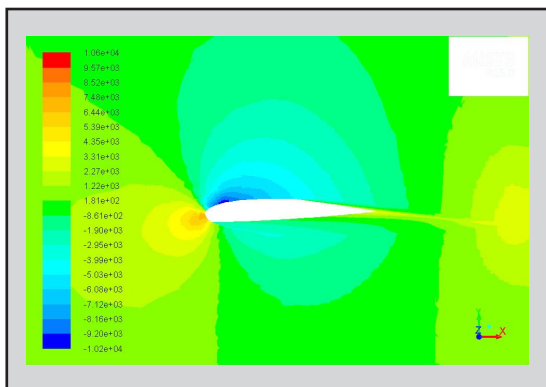
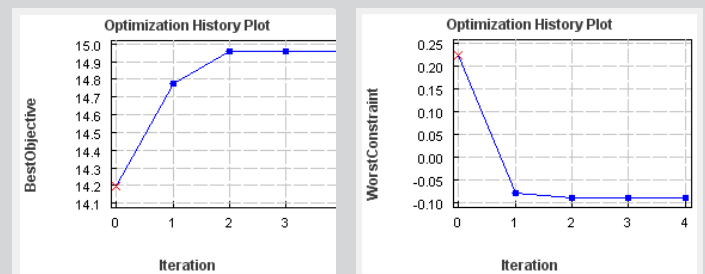Analysis on the Optimized Wing Shape

Wing Shape Optimization

Problem Setup and Parametrization
ANSYS Workbench


```
input.txt - Notepad
File Edit Format View Help
P14  backsweep_angle 159.119594  [degree]
P15  quarter_chord  0.90139796  [m]
P16  wing_span_cal 7.6352115  [m]
P18  taper  0.44371075  []
P17  chord_length_cal 3.60559184  []
P20  V_in  150.0  [m s^-1]
P10  field_length  30  [m]
P11  field_height  20  [m]
P19  angle_of_attack  4.20000456  [degree]
```

Call ANSYS Workbench

```
output.txt - Notepad
File Edit Format View Help
P7  Total Deformation Maximum 5.21288344348768  [mm]
P8  Equivalent Stress Maximum 8.4869577676801917  [MPa]
P9  Maximum Principal Stress Maximum 10.97527523221081  [MPa]
P22  Lift  128786.3  [N]
P21  Drag  9288.5086  [N]
P23  Wing_Solid Volume  4295974381.93309  [mm^3]
```

VisualDOC Workflow and Data Exchange

Optimization History

VR&D Products

GENESIS - Structural Analysis & Optimization

GENESIS is a fully integrated finite element analysis and design optimization software package. Analyses include static, normal modes, direct and modal frequency analysis, heat transfer and system buckling. Design optimization is based on the advanced approximation concepts approach to find an optimum design efficiently and reliably. Actual optimization is performed by the well established DOT and BIGDOT optimizers, also from VR&D. Design capabilities include: topology, shape, sizing, topography, topometry, and freeform optimization. Typically the optimization requires less than ten detailed finite element analyses, even for large and complex design tasks.

Design Studio for GENESIS

Design Studio for GENESIS is a design oriented pre- and post-processor graphical interface for the GENESIS program. It features built-in and easy-to-use trails for setting up the optimization problem and running GENESIS from the interface. It also supports post-processing of the optimization results with contour plots, deformed plots, animations, etc.
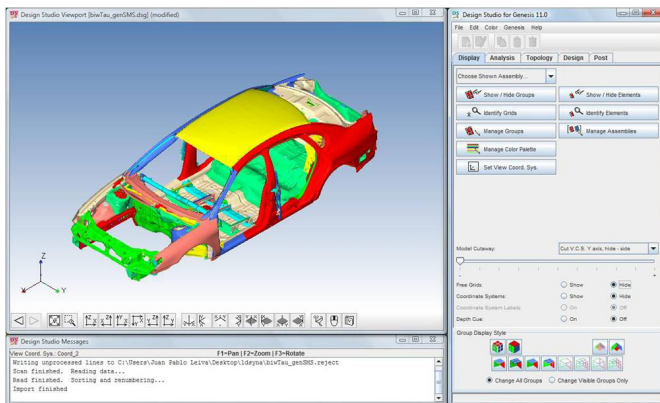
Design Studio for GENESIS

VisualDOC - Multidiscipline Design Optimization

VisualDOC is a software system that simplifies adding optimization to almost any design task. It uses a powerful intuitive graphical interface, along with gradient based and non-gradient based optimization, response surface (RS) approximate optimization, and design of experiments (DOE) methods. VisualDOC interfaces easily to your own code or third-party analysis programs.

DOT - Design Optimization Tools

DOT is a general purpose numerical optimization software library which can be used to solve a wide variety of nonlinear optimization problems. If you require only an optimization engine to incorporate into your design software, DOT will serve that purpose.

BIGDOT

BIGDOT is intended to solve very large, nonlinear, constrained problems where gradient information is available, and function and gradient evaluation is efficient. BIGDOT is capable of solving continuous, discrete/integer or mixed variable problems. Problems in excess of three million variables have been solved by BIGDOT.

SMS Fast Eigensolver

The SMS eigensolver may be added to existing NASTRAN installations to offer significant performance advantages over the default method when a large number of eigenmodes are required for a system with many degrees of freedom. Benchmark studies and user experience show 2-10 times speedup. SMS may also be embedded into your product/software.

ESLDYNA - Optimization Software that Couples GENESIS to LS-DYNA Nonlinear Structural Analyses

ESLDYNA is based on the Equivalent Static Loads (ESL) method to perform optimization based on a nonlinear finite element analysis with GENESIS as the structural optimization program. ESLDYNA takes advantage of the capability of GENESIS, a linear structural optimization program, to solve large scale optimization problems based on the responses from a nonlinear finite element analysis. It also helps to significantly reduce the design time by identifying high performance designs with five to ten nonlinear analyses.

GTAM-GENESIS Topology for ANSYS Mechanical

GTAM is an integrated extension that adds topology optimization to the ANSYS environment. Designers benefit by autommatically generating innovative designsin a reliable, robust, and easy-to-use interface.

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