

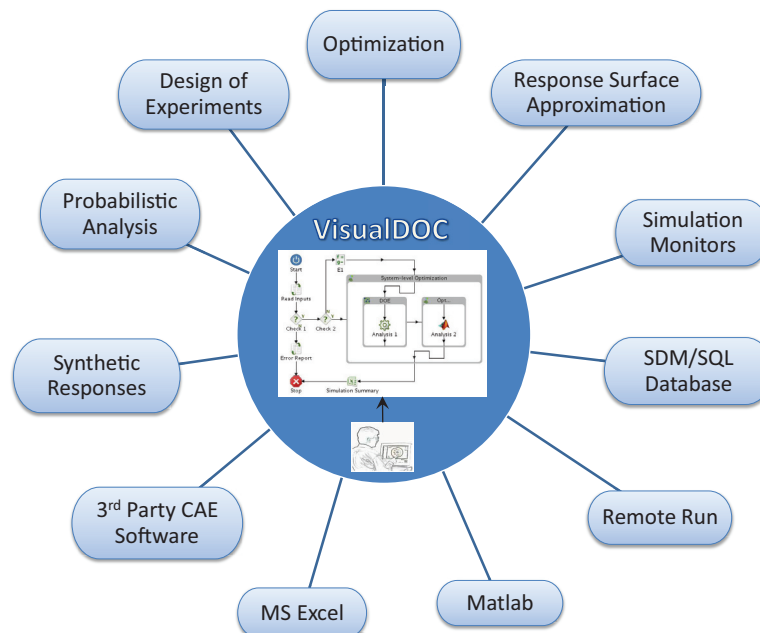
VisualDOC

Design, Optimization, and Process Integration Software

VisualDOC is a multidisciplinary design, optimization, and process integration software. It is a tool for design process definition, integration, execution, and automation. The design modules included are Optimization, Design of Experiments, Response Surface Approximation, and Probabilistic (Robust and Reliability-based) Analysis. VisualDOC can be used to add these modules to almost any analysis program.

VisualDOC graphical user interface allows the user to easily create a connected work-flow of components and configure them. It's features include comprehensive concurrent monitoring and visualization tools, storage and reuse of generated simulation data for post-processing, full debugging support for model execution, and the ability to interactively inspect and monitor the design process.

VisualDOC also supports batch-mode execution and provides programmatic access to all the included design modules. It can integrate with Excel, Matlab, various CAE software, and user-defined libraries and executables.



Increase efficiency

- Automate your processes
- Reduce design cycle time
- Increase product reliability

Used by engineers worldwide

Get your products to market faster

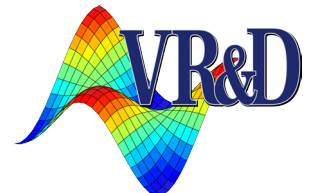
- From concept to preliminary design to detailed design, to manufacture

Share and leverage design data

- Share information and data for better decision making

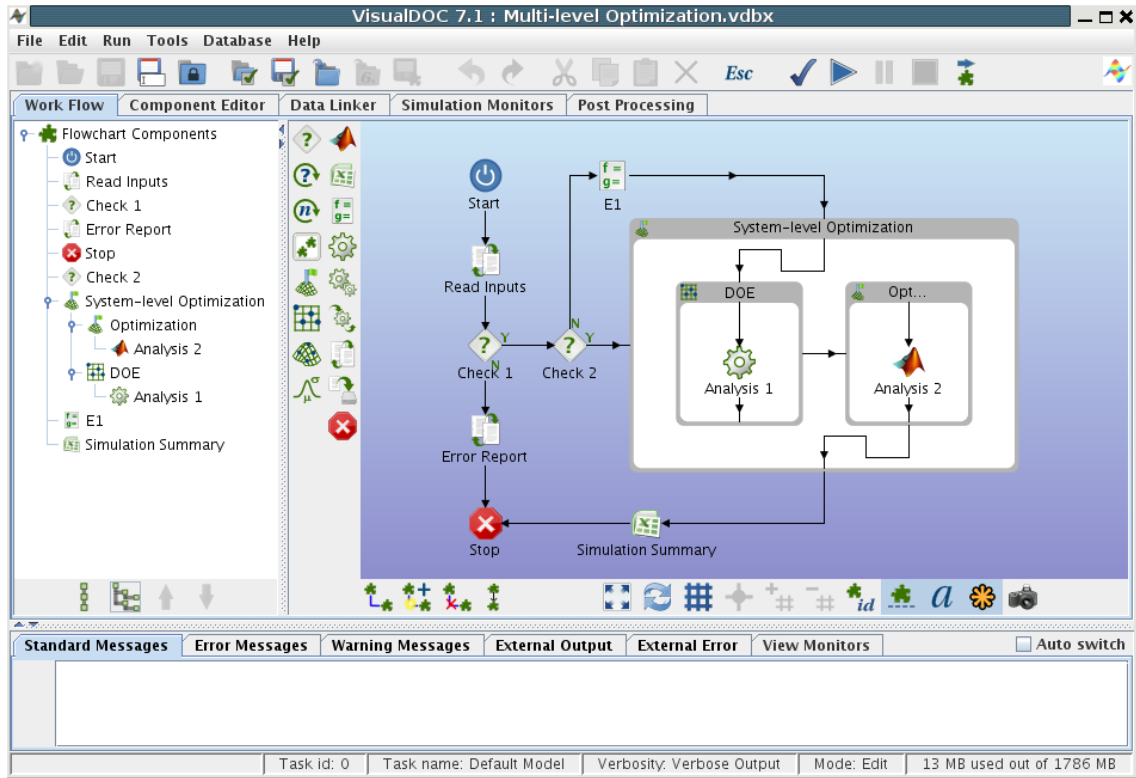
Combine data from multiple disciplines

- Perform trade-off studies
- Identify important design parameters



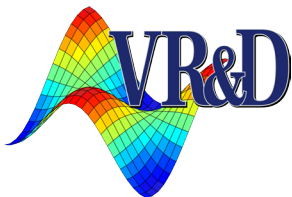
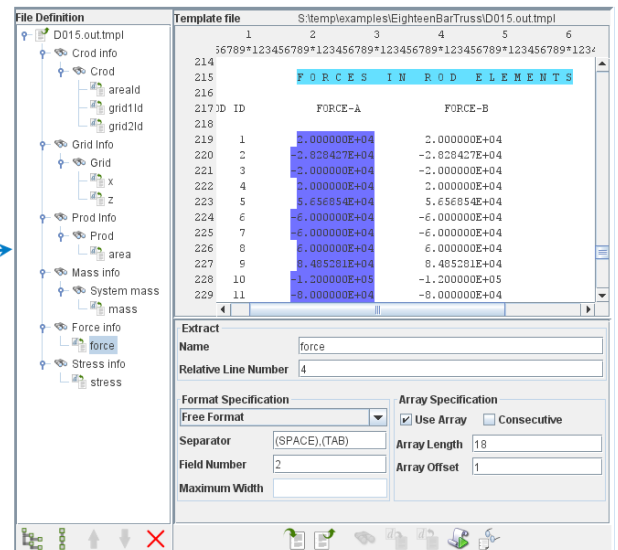
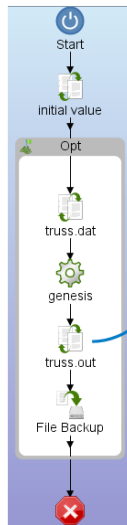
Capabilities

- Task management (versions)
- Powerful & flexible auto-complete
- Full parameterization
- Synthetics for analytic functions
- Multi-dimensional arrays
- Large data support
- Remote execution
- Batch/cyclic/conditional execution
- Execute only a part of a model
- Break-points for debugging
- Start/stop/pause model execution
- Import/export/reuse simulation data
- SQL database support with indexing
- Multi-level OPT/DOE/RSA/PROB etc.



Process Integration

- Import/Export components in and out of VisualDOC
- Direct communication with MS Excel and Matlab
- External CAE software (e.g. Genesis, LS-DYNA, PamCrash, etc.)
- User-defined executables and shared libraries
- Read/Write almost any fixed or free format ASCII data file



VisualDOC Design Modules

Optimization

- State-of-the-art DOT and BIGDOT optimizers
- Non-traditional optimizers such as NSGA-II and PSO

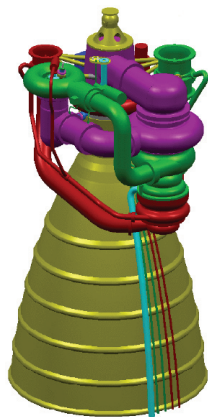
Design of Experiments (DOE)

- 10+ types of DOE designs including user-defined
- Non-standard design space defined by relationships between design variables
- Approximations from generated DOE points
- Surrogate modeling for optimization

Sample Applications



Dynamic Balancing of Gimbaled Sensor Platform



Rocket Nozzle Optimization



Turbo Machinery - MDO - Fluid & Structural



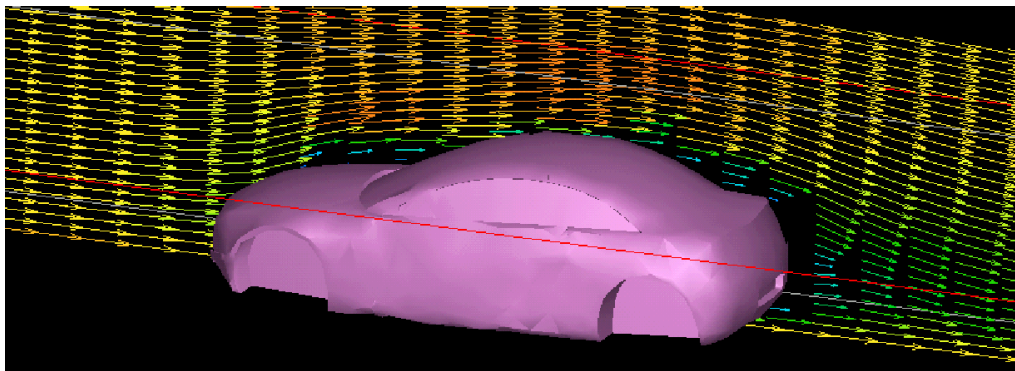
Response Surface Optimization

- Optimization technique + DOE design + Approximation method
- Approximate model continuously updated
- Very few function evaluations

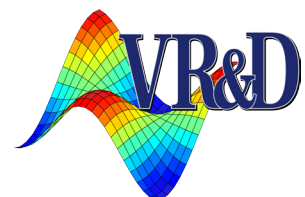
Probabilistic Analysis

- Large number of probability distributions
- Reliability and robustness studies
- System series/parallel probability of failure
- *n*-sigma design

| | |
|--|--|
| Optimizer | Gradient Based Optimization |
| Constrained Method | |
| <input checked="" type="radio"/> | Modified Method of Feasible Direction (MMFD) |
| <input type="radio"/> | Sequential Quadratic Programming (SQP) |
| <input type="radio"/> | Sequential Linear Programming (SLP) |
| <input type="radio"/> | Sequential Unconstrained Optimization (BIGDOT) |
| Unconstrained Method | |
| <input checked="" type="radio"/> | Broydon-Fletcher-Goldfarb-Shanno (BFGS) |
| <input type="radio"/> | Fletcher-Reeves Method |
| <input type="radio"/> | Sequential Unconstrained Optimization (BIGDOT) |
| Gradient | |
| Gradient Calculation | Forward Difference |
| Relative Finite Difference Step Size | 1.0E-3 |
| Absolute Finite Difference Step Size | 1.0E-4 |
| Stopping Criteria | |
| Relative Objective Convergence | 1.0E-3 |
| Absolute Objective Convergence | 1.0E-6 |
| Maximum Number of Iterations | 100 |
| Iterations for Convergence | 2 |
| <input type="checkbox"/> Show Advanced Options | |
| Defaults | |

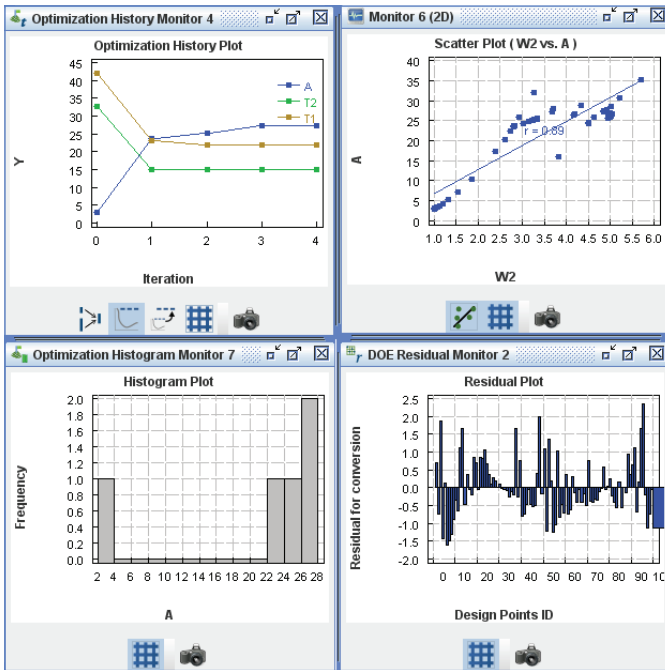


Aerodynamic Shape Optimization of Car Body



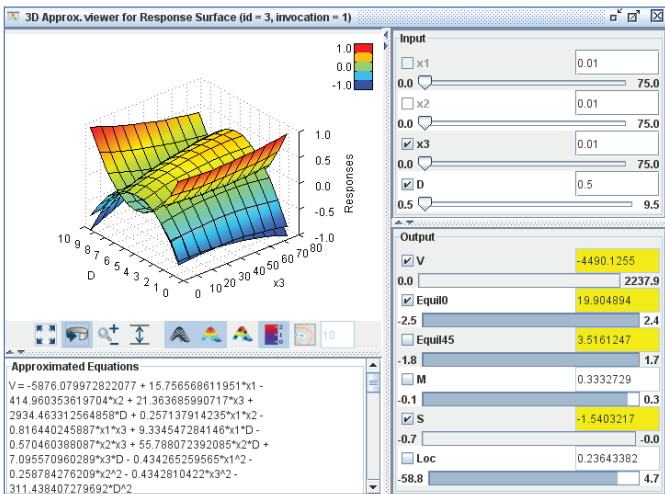
Concurrent Monitoring

- Real-time visual feedback
- Can add any number of simulation monitors before/during/after a simulation
- Textual, tabular, and graphical visualization
- Large number of plot types (2D, 3D, line, scatter, surface, frequency, correlation, matrix, and more)



Post Processing

- Summary reports, design point tables, etc.
- Interactive post-processors (set analysis, approximation viewers, etc.)



Other VR&D Products

GENESIS – Structural Analysis & Optimization

GENESIS is a fully integrated finite element analysis and optimization software. Analyses include static, normal modes, direct and modal frequency analysis, heat transfer, system buckling, and random response. Shape, sizing, topography, topometry, topology, and freeform optimization are the design options available to the user. Typically the optimization requires less than ten finite element analyses to converge even for large problems.

Design Studio for Genesis – Graphical Pre/Post Processor

Design Studio allows users to display finite element models, easily create GENESIS design data, and post-process optimization results.

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.

DOT – Design Optimization Tools

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

BIGDOT – Very Large Scale Optimizer

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

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