VisualDOC

VR&D's Next Generation Design Optimization Software System

www.vrand.com

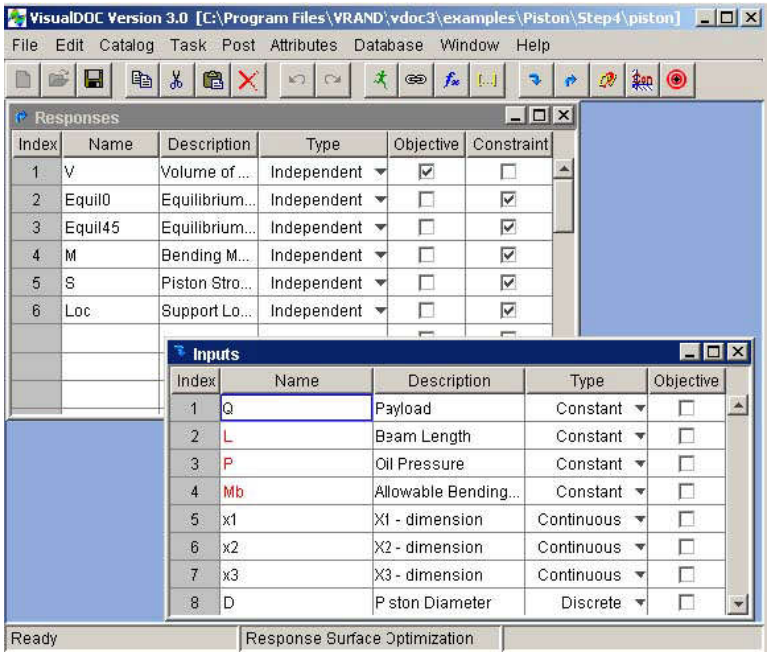
Description

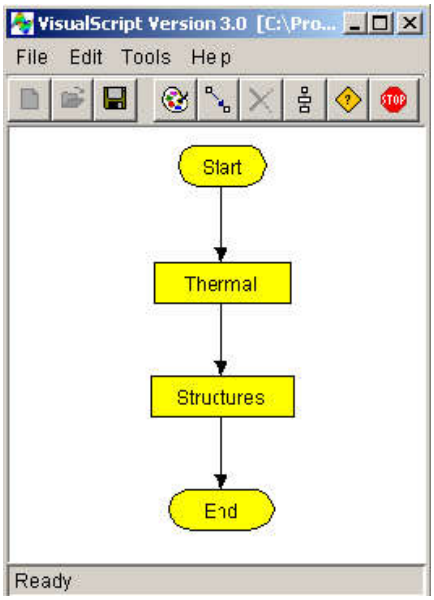
VisualDOC is a software system that simplifies adding optimization to almost any design task. It uses a powerful, intuitive graphical user interface along with state-of-the-art optimization algorithms to setup, solve, and post-process your design.

VisualDOC provides gradient, non-gradient and response surface based optimization algorithms along with design of experiments. VisualDOC can be used for any design problem since you direct VisualDOC by defining what parameters may change (design variables) and measures of design quality (responses). You specify to VisualDOC what program calculates the responses. Alternatively, developers can embed VisualDOC in their applications.

VisualDOC solves the design problem by calling the optimizer to modify the design variables and then calling the program that calculates the responses. Once you specify the design process, VisualDOC does all the work.

Beginning with version 2.0, VisualDOC has been significantly enhanced by the addition of a platform-independent graphical user interface and design database. Other improvements include advances in response surface approximation, design of experiments, discrete variable optimization, and a process integration module called VisualScript.





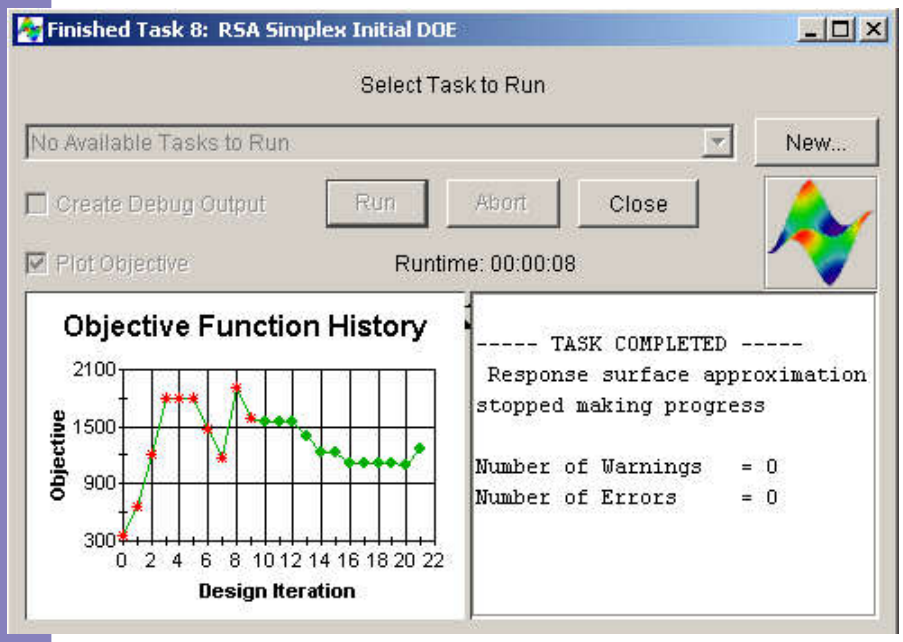
- **Powerful, intuitive graphical user interface**
  - Pre/Post process design optimization data
- **Design database**
  - Store/Retrieve/Organize design optimization data
- **State-of-the-art design optimization algorithms**
  - Gradient based optimization
  - Non-Gradient based optimization
  - Response surface (RS) approximate optimization
  - Design of Experiments (DOE)
- **Multidisciplinary Design Optimization**
- **VisualScript -Process Integration Tool**
  - Tools to interface analysis codes to VisualDOC - eliminates programming
- **Application Program Interface**
  - Functions for embedding VisualDOC in your applications
- **Parallel/Distributed Computing**
- **Probabilistic Optimization**

Inside

How does VisualDOC work?

VisualDOC incorporates a multi-user, platform independent database that can be viewed as a container for all design data. A design study starts with the definition of a design project in a database, which entails creating design variables, objective functions, constraints, etc.

When ready to calculate an optimum design, you first create a design task via the VisualDOC GUI. A design task serves as a "snap-shot" of the current design study. You may create multiple design tasks in a single database. When you run a design task, VisualDOC's design modules continuously update the database. The VisualDOC database does not have any intrinsic limits to the number of design tasks and associated results that it can hold. Results can be post-processed using the report module and graphing capabilities in the GUI. VisualDOC not only performs design optimization but also provides insight into the design problem itself.



Graphical User Interface

- Easy to use Graphical User Interface (GUI)
- Pre- and post-processing of design information
- Supports real time progress monitoring
- Uniform interface accross all supported platforms

Gradient Based Optimization Algorithms

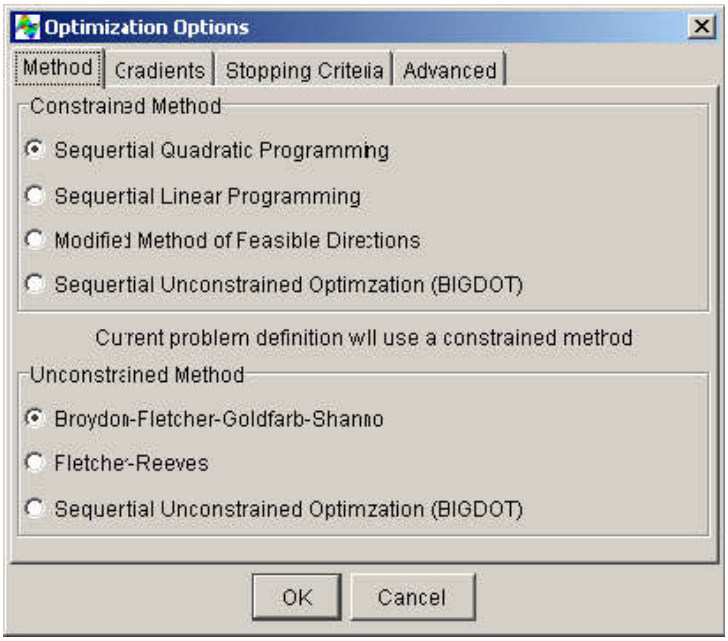
Users can provide gradients to VisualDOC, or VisualDOC will calculate the gradients using finite difference methods.

Constrained Optimization:

- Sequential Quadratic Programming (SQP)
- Sequential Linear Programming (SLP)
- Modified Method of Feasible Directions (MMFD)
- Sequential Unconstrained Optimization (BIGDOT)

Unconstrained Optimization:

- Broydon-Fletcher-Goldfarb-Shanno
- Fletcher-Reeves
- Sequential Unconstrained Optimization (BIGDOT)



Non-Gradient Based Optimization Algorithms

- Genetic Algorithm
- Particle Swarm Algorithm

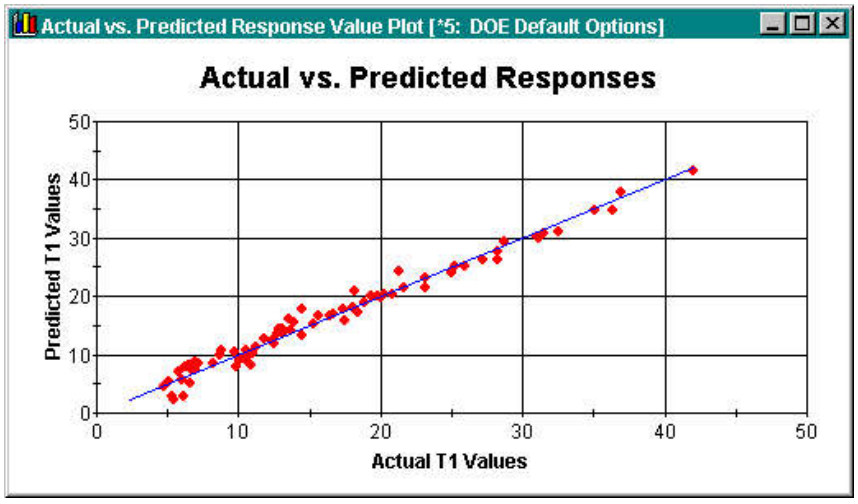
Contact VR&D for engineering services

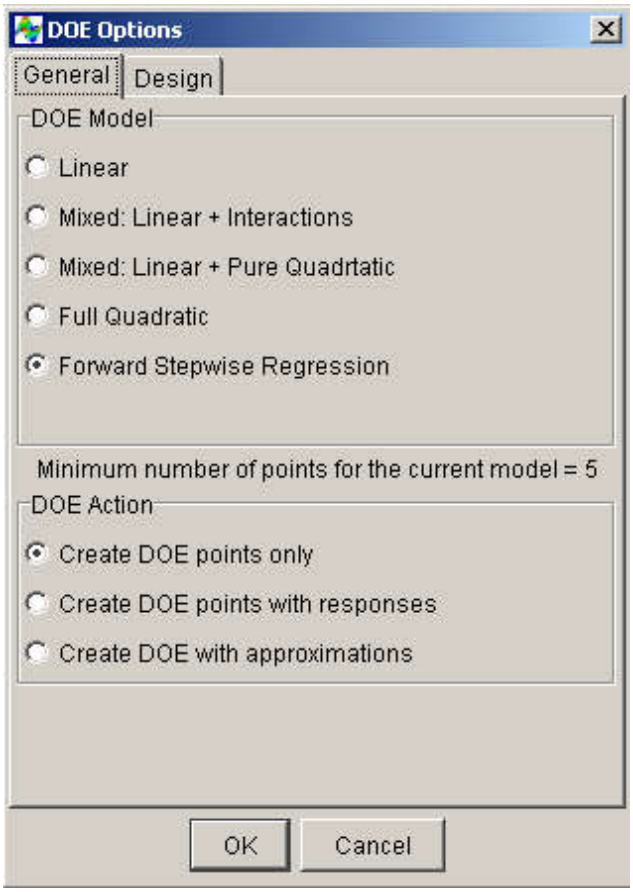
VisualDOC

RESPONSE SURFACE APPROXIMATE OPTIMIZATION

VisualDOC's Response Surface Approximate (RSA) Optimization design module allows you to apply optimization to computationally intensive tasks that might otherwise be intractable.

Using an adaptive, nonlinear update process, the RSA design module continuously improves the approximation as the design progresses. The RSA procedure can be started by an initial design of experiments, user defined points, or using a Taylor series strategy. Discrete and/or Integer problems are also supported.





DESIGN OF EXPERIMENTS

The Design of Experiments (DOE) module in VisualDOC consists of 10 major statistical design types, most with multiple derivatives. In addition, users can create irregular design spaces by enforcing constraints on design variables.

Using the statistical designs, VisualDOC provides several advanced options for generating response surface approximations including mixed-forward regression. VisualDOC presents users with a wide variety of DOE post-processing options, including detailed ANOVA tables, residual analyses, and various plots.

EXPERIMENTAL DESIGNS

- Factorial
- Composite
- Taguchi
- Box-Behnken
- User Supplied/ Experimental Data
- D-optimal
- Koshal
- Simplex
- Random
- Latin Hypercube

Visit www.vrand.com for more information

Applications

VisualDOC can be used to apply optimization to a wide range of design problems from automotive to aerospace applications.

Example Applications:

- Aircraft Wings
- Car bodies
- Air induction systems
- Inverse engineering
- Process engineering
- Financial analysis
- Jet engines
- Hybrid vehicles
- Heat exchangers
- Robotics
- Suspension systems

Supported Platforms

- HP - HP-UX 11.x
- SGI - IRIX 6.x
- SUN - Solaris 2.x
- IBM - AIX 4.x
- Compaq/DEC Alpha
- Intel x86 - Windows 9x, 2000, NT, Linux

Related Products from VR&D

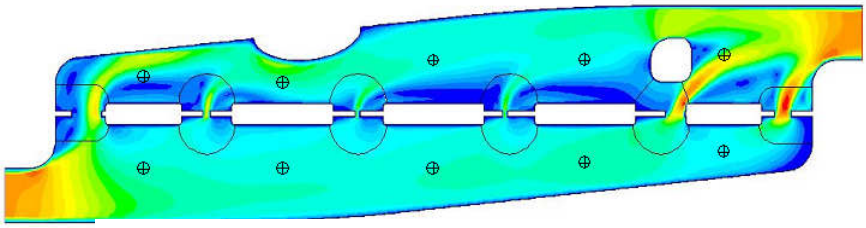
GENESIS - Structural Analysis and Optimization Software

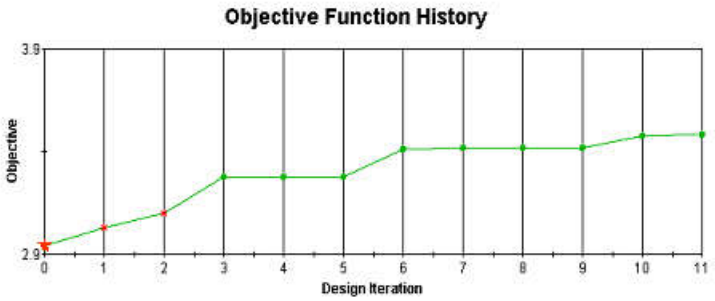
GENESIS is a fully integrated finite element analysis and design optimization software package. Analyses include static, normal modes, direct and modal frequency analysis, heat transfer and system buckling. Shape, sizing and topology optimization are the design options available to the user. Typically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

DOT/BIGDOT - Design Optimization Tools

Intended for developers who need gradient-based optimization to solve a wide variety of nonlinear optimization problems. If you require only an optimization engine to incorporate into your design software, DOT/BIGDOT will serve that purpose.

Design Optimization of a Cooling System





12 Design Variables 10 Design Constraints
11 Design iterations, 24 CFD Calls

VR/Nastran - Next Generation Finite Element analysis

VR/Nastran data is compatible with other Nastrans but was created using modern programming, data management, element and solution technology. The current release solves analysis problems in linear static, inertia relief analysis, dynamic normal modes, buckling, frequency response and heat transfer analysis.

Vrand/SMS - The Nastran Accelerator

SMS allows eigensolutions to run several times faster than the conventional Lanczos method. Using SMS, performance improves as the FEA model size increases. SMS is available in an external solver called Vrand/SMS, which can work together with MSC.Nastran to speed up large eigenproblems. SMS is contained in both GENESIS and VR/Nastran.

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February 2004