

# Isight

Automate Design Exploration and Optimization



# Isight

## See Your Way to a Better Design

Simulation process automation and design optimization solutions—reduce time and costs while significantly improving product performance, quality, and reliability

### Industry Challenges

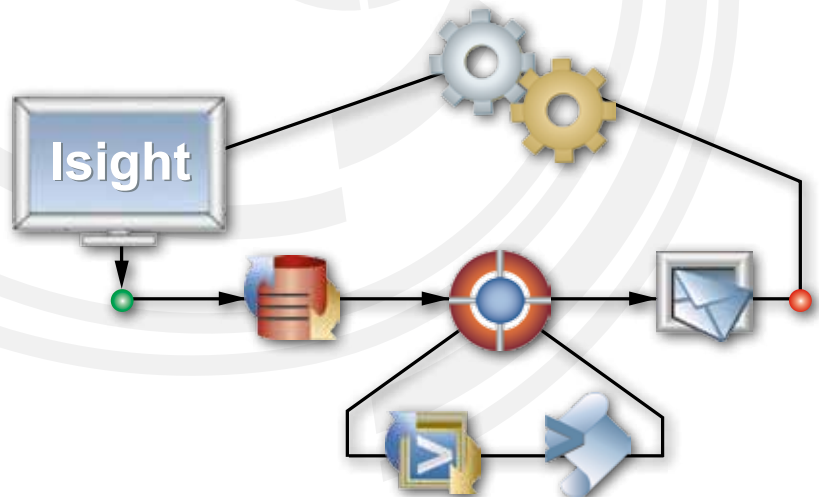
In today's computer-aided product development and manufacturing environment, designers and engineers are using a wide range of software tools to design and simulate their products. Often, the parameters and results from one software package are required as inputs to another package, and the manual process of entering the required data can reduce efficiency, slow product development, and introduce errors in modeling and simulation assumptions.

Isight provides designers, engineers, and researchers with an open system for integrating design and simulation models—created with various CAD, CAE and other software applications—to automate the execution of hundreds or even thousands of simulations. Isight allows users to save time and improve their products by optimizing them against performance or cost metrics through statistical methods such as Design of Experiments (DOE) or Design for Six Sigma.

### Process Automation and Design Optimization

Isight combines cross-disciplinary models and applications together in a simulation process flow, automates their execution, explores the resulting design space, and identifies the optimal design parameters subject to required constraints.

Isight's ability to manipulate and map parametric data between process steps and automate multiple simulations greatly improves efficiency, reduces manual errors, and accelerates the evaluation of product design alternatives.



## Open Component Framework

Isight provides a standard library of components, or containers, with unique interfaces for integrating and running a particular model or simulation, which form the building blocks of simulation process flows.

The direct link between Isight and the components allows for easy modification of a reference input deck, execution of the component, and the extraction of the output information. Isight comes with a set of components for a wide variety of applications like Excel™, Word™, MATLAB®, COM, Text I/O applications, Java and Python Scripting, and databases.

A full featured development environment, based on Eclipse™, supports the development of components, whereas the open API extends additional Isight capabilities. This open architecture allows SIMULIA and its partners to offer application components that provide a tighter integration with models developed in popular engineering software applications.

Isight enables partners and customers to add custom design techniques, including DOE, approximation, approximation error analysis, optimization, Monte Carlo sampling methods, and random variable distributions. This approach makes it easier to create process flows, reduce maintenance costs, and provides timely access to new components or updates through an independent release process.



## Creation of Simulation Process Flows

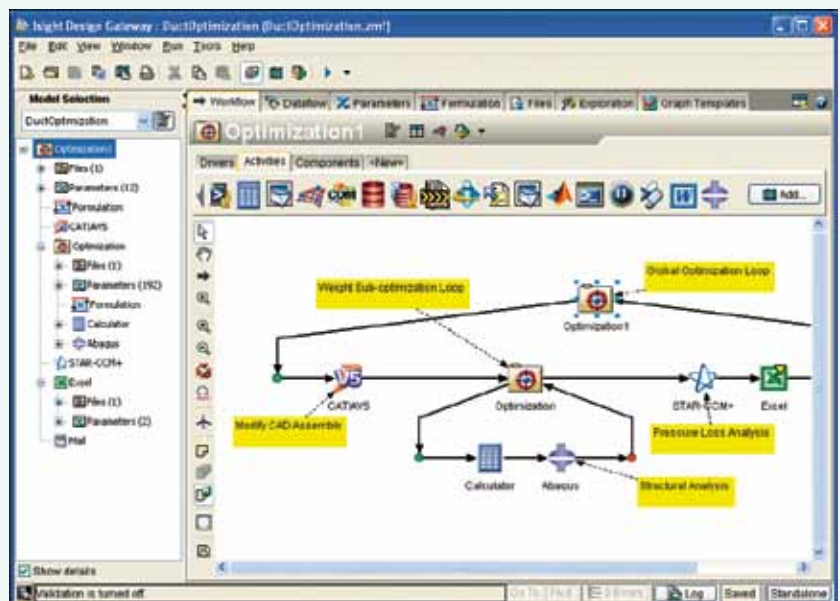
The intuitive Design Gateway graphical user interface enables users to quickly create integrated simulation process flows, which couple simulation programs regardless of discipline, programming language, or format. It provides drag-and-drop process flow creation, parameter mapping, and problem formulation. This feature-rich process editor supports powerful file parameters that can represent simulation models as variables, as well as dynamically sizable arrays for both inputs and outputs. The software also provides branching, looping, conditional, and other execution logic. This flexibility, combined with scripts to alter the runtime behavior of the model as a function of changing parameter values, allows the creation of highly reusable processes. Once the process flow is defined, the user interface enables easy import of externally defined parameter values and problem formulations. Utilities such as model search, model content viewer, parameter search, and parameter grouping are also available.

## Execution, Results Visualization, and Postprocessing

The Runtime Gateway enables local execution of engineering process flows and creation of graphs and tables to visualize results. All job results are saved automatically to a locally managed MySQL database. The user interface supports the creation of visual tools for real-time postprocessing of data such as tables, 2D and 3D plots, and statistical analysis. Run data can be filtered and graded with a flexible set of criteria before postprocessing. All scatter plots allow easy one-click visualization of the virtual prototype by dedicated simulation results viewers. It provides interactive tools for visualizing parameter relationships as well as performance attribute tradeoffs with interactive approximations. Users can share these approximations with non-Isight users by exporting them to Excel.

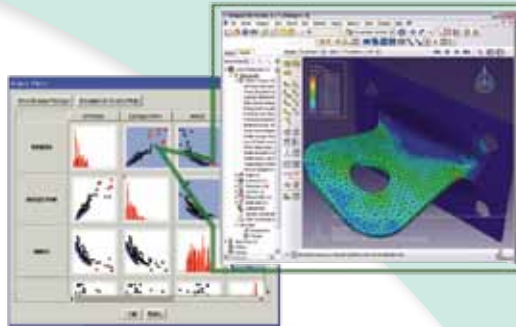
“Isight offers an extensive library of parallel process components, such as Design of Experiments & Optimization as well as Approximation methods that enable engineers to thoroughly and quickly explore the design space.”

*Isight provides an easy-to-use drag-and-drop interface to quickly create integrated simulation process flows.*



## Explore design space with Isight's extensive library of parallel process components.

Isight is offered as a standalone desktop product. However, any simulation process flow created with Isight can be seamlessly executed on the SIMULIA Execution Engine from the Runtime Gateway.



Point cloud scatter plots of simulation results with run grading. Abstract data, like a stress field computed with Abaqus, can be visualized with one click in its native viewer.



### Design of Experiments

The Design of Experiments (DOE) component enables engineers to quickly assess the impact of the various design variables on the objectives and identify significant interactions among the design variables. The structured set of design data produced by DOE runs also can be used in conjunction with approximation models for use with optimization methods.



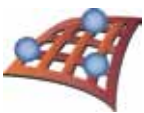
### Optimization

Isight provides a comprehensive selection of parallelized optimization techniques that can be applied to a variety of problems, and includes several techniques that can handle multi-objective optimization problems.



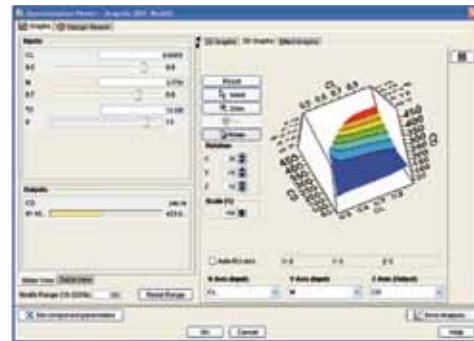
### Data Matching

Data Matching is a process in which simulation models are calibrated by minimizing any of a variety of different error measures using optimization techniques. Target data can be either imported experimental results or simulation results generated by a higher-fidelity code.



### Approximations and the Visual Design Driver

Approximations are powerful real-time tools to interpolate results of computationally intensive realistic simulations. Approximation models are automatically cross-validated to ensure accurate predictions. The Visual Design Driver allows users to see their approximation models from many different views and “surf” the design space graphically and interactively. The Visual Design Driver window provides a parameters panel that can display the parameters in either a slider or table interface. The sliders are directly coupled to all plots currently being viewed, and the plots change as the sliders are moved.



The Visual Design Driver allows real-time interactive tradeoff of approximated design characteristics.



### Quality Methods

Isight provides stochastic methods that account for variation in product designs and the environment in which they operate. The Monte Carlo Simulation (MCS) component offers an accurate method to address uncertainty and randomness in the design process. It allows users to sample the design space, assess the impact of known uncertainties in input variables on the system responses, and to characterize the statistical nature (mean, variance, range, distribution, etc.) of the responses of interest. The MCS component can also be used in conjunction with the approximation methods.

Using the Six Sigma reliability and robustness analysis component, a product or process is simulated repeatedly while varying the stochastic properties of one or more random variables to characterize the statistical nature of the responses of interest. The “sigma level,” or probability of satisfying design specifications, is reported along with performance variation statistics. The reliability analysis can be performed with a parallel 1st or 2nd order method, a Monte Carlo, or a DOE.

The Taguchi component can be used to improve the quality of a product or process by not only striving to achieve performance targets, but also minimizing performance variation.

## Baker Hughes Reduces Development Time from Months to Days

The use of expandable tubulars has emerged as a popular technology for drilling and completing wells. While expandable tubulars vary in type depending upon the application and specific well requirements, the most common approach is to actually form the metals downhole, which presents unprecedented challenges for tool designers. The costs and timelines to achieve a “workable” product can be tremendous. Baker Hughes has effectively leveraged realistic simulation to address these impediments and enhance their understanding of the mechanics and effects of nonlinear/dynamic expansion of metals.

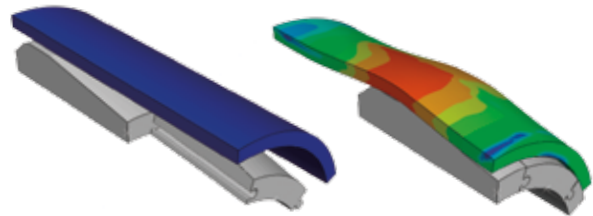
Download the full paper at [www.simulia.com/cust\\_ref](http://www.simulia.com/cust_ref).

“If we hadn’t been using the software, the most effective cone geometry would have never been considered.”

–Jeff Williams, project engineer,  
Baker Hughes



Images courtesy of Baker Hughes



The aircraft turbine is an extremely complex mechanical system. This photograph is reproduced with the permission of Rolls-Royce plc, copyright © Rolls-Royce plc 2009.

## Rolls-Royce Assesses Variability to Achieve Robust Design

The airplane engine business is a highly competitive market and gas turbine engines are at the leading edge of technology development. In recent years, the application of optimization techniques and simulation-driven design during the development of engines has become a standard practice. To ensure the safe and reliable operation of the components and engine over the complete lifetime and in all operating conditions, it is important to look at the performance of the components at the nominal design definition stage, as well as to account for variabilities that may occur during the manufacturing process and use of the products. Rolls-Royce is using such techniques to shorten the development time for gas turbines and reduce development costs.

Download the full paper at [www.simulia.com/cust\\_ref](http://www.simulia.com/cust_ref).

“Why did we implement robust design at Rolls-Royce? Because we realized, early on, that the sheer size and complexity of the aircraft engine design and development “problem” could only be mastered through a combination of simulation, process automation and optimization.”

–Alexander Karl, Lead, Robust Design,  
Rolls-Royce, Indianapolis

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## About SIMULIA

SIMULIA is the Dassault Systèmes brand that delivers a scalable portfolio of Realistic Simulation solutions including the Abaqus product suite for Unified Finite Element Analysis, multiphysics solutions for insight into challenging engineering problems, and SIMULIA SLM for managing simulation data, processes, and intellectual property. By building on established technology, respected quality, and superior customer service, SIMULIA makes realistic simulation an integral business practice that improves product performance, reduces physical prototypes, and drives innovation. Headquartered in Providence, RI, USA, SIMULIA provides sales, services, and support through a global network of regional offices and distributors.

For more information, visit [www.simulia.com](http://www.simulia.com).

