

Isight and Fiper

Automate Design Exploration and Optimization



Isight and Fiper

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.

SIMULIA provides market-leading solutions that improve the process of leveraging the power of various software packages. Isight and Fiper are used to combine multiple cross-disciplinary models and applications together in a simulation process flow, automate their execution across distributed compute resources, explore the resulting design space, and identify 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.

Process Automation and Design Optimization

Isight (formerly known as iSIGHT-FD) is a desktop solution that provides a suite of visual and flexible tools for creating simulation process flows—consisting of a variety of applications, including commercial CAD/CAE software, internally developed programs, and Excel spreadsheets—in order to automate the exploration of design alternatives and identification of optimal performance parameters.

Isight enables users to leverage advanced techniques such as Design of Experiments, Optimization, Approximations, and Design for Six Sigma to thoroughly explore the design space. Advanced, interactive postprocessing tools allow engineers to explore the design space from multiple points of view.

Fiper, an add-on product to Isight, enables users to share Isight simulation process flows, distribute and parallelize their execution across available compute resources, and share results. The Fiper add-on can be accessed directly from Isight or from a web interface.

Open Component Framework

Isight provides a standard library of components, which form the building blocks of Isight simulation process flows. A component is a container with its own interface for integrating and running a particular model or simulation application directly from within Isight.

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

An open API and a Component Generator support the development of components by partners and customers. The Component Generator is a tool for wrapping components, creating custom GUIs for wrapped components, and extending your Isight capabilities. It offers a standard Java™-based capability to wrap applications so that they become Components which can be plugged into the open component architecture.

Create Simulation Process Flows

The easy-to-use graphical drag-and-drop interface enables users to quickly create integrated simulation process flows, which couple simulation programs regardless of discipline, programming language, or format. The Task Plan Component Editor can be used to modify and control the coupled simulation process flows by adding or subtracting design drivers, editing design driver details, and turning drivers on or off. The software also provides branching, looping, conditional, and other execution logic.

Add-on and Partner Components

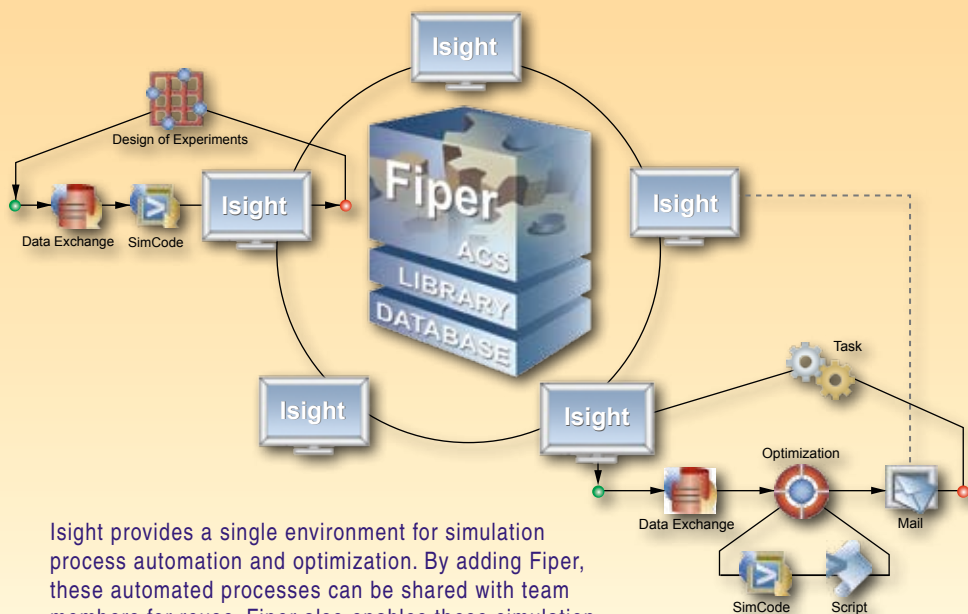
In addition to the generic integration technology, SIMULIA offers add-on and partner components that provide a tighter integration with models developed in select software applications, such as Abaqus, CATIA V5, MADYMO, Pro/Engineer, Ansys, SEER, STAR-CMM+, AVL, or Nastran. This approach makes it easier to create process flows, reduces maintenance costs, and provides timely access to new components or updates through an independent release process.

Execute and Share Simulation Process Flows

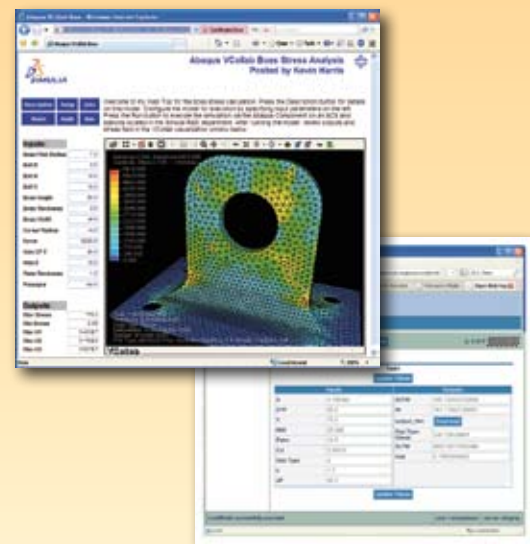
Fiper enables users of Isight to leverage distributed computing resources for the efficient execution of simulation process flows. By using Fiper, users, administrators, and IT organizations are able to control where models are executed from and the process by which they are run, allowing for optimum use of hardware and computing resources. The software integrates seamlessly with existing enterprise Web application servers and databases.

Isight users are able to publish simulation process flows to distributed computing resources by registering them with the Fiper Application Control System (ACS). The models are stored in a version-controlled library so they can be shared and reused. It is also possible to connect ACSs together so that multiple components of the model can reside in physically remote locations. The Fiper ACS automatically creates a standard webtop representation of the simulation process flow that can be accessed from a simple Web browser. Webtops can also be customized as model-based applications.

Complex design study jobs are executed through a powerful computing framework consisting of stations that have been configured to receive work in a parallel, distributed grid-like system. Stations work seamlessly with existing grid software such as Platform LSF. Job run locations are transparent to the end users, and multi-run simulations that involve thousands of simulations are automatically distributed to multiple stations to reduce execution time.



Isight provides a single environment for simulation process automation and optimization. By adding Fiper, these automated processes can be shared with team members for reuse. Fiper also enables these simulation process flows to be executed from a Web browser.



The top image shows a Web client that is customized to run and postprocess a particular Abaqus simulation process flow. The bottom image shows the standard Web client which will run any simulation process flow created in Isight.

Isight offers an extensive library of advanced techniques, such as Design of Experiments, Optimization, Approximations, and Design for Six Sigma, that enable engineers to thoroughly explore the design space.

Design of Experiments

The Design of Experiments (DOE) component enables the systematic and efficient analysis of the design space. Engineers are able 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 experimental design data produced by DOE runs also can be used in conjunction with approximation models for use with optimization methods.

DOE methods included are central composite, full factorial, Latin Hypercube, optimal Latin Hypercube, orthogonal arrays, and parameter study. In addition, an external data file can be used to define the matrix of experiments. The DOE Component Editor allows DOE techniques to be selected, configured, and monitored during the generation of the DOE matrix.

Optimization

Isight provides a comprehensive selection of numerical and exploratory Optimization techniques that can be applied to a variety of problems. These include numerical optimizers such as NLPQL and Hooke-Jeeves, as well as the Pointer automatic optimizer—an easy-to-use hybrid technique that can tune and train itself. The software also includes several techniques that can handle multi-objective optimization problems like AMGA, NSGA-II, and NCGA. The Optimization Component Editor allows Optimization techniques to be selected and easily configured.

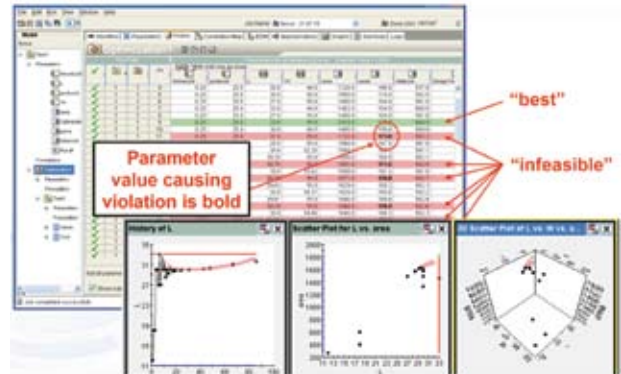
Approximations

The approximations component is a powerful tool for using optimization techniques with computationally intensive realistic simulations. The tool enables the simulation models to be replaced with fast-running surrogate models. Approximation models can be created using response surface models (RSM) and radial basis function (RBF) neural networks. A setup wizard guides users in defining an approximation model and the Approximation Editor allows the user to edit, delete, or activate existing approximations, as well as create new approximations. Approximation models can be created as independent activities or applied to any process flow or activity component such as a simcode or calculation block.

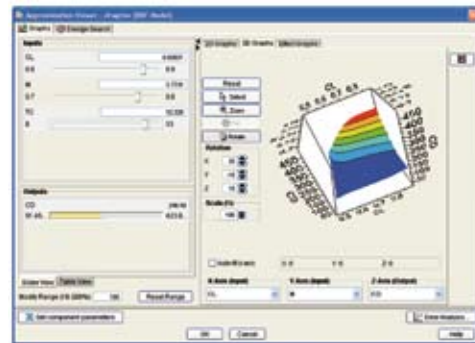
Approximation model accuracy can be assessed using the Error Analysis GUI. Graphs of predicted vs. actual output values are provided for each approximated output response. Using plug-ins, users can provide their own error analysis methods.

Visual Design Driver

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.



When Isight completes the design exploration runs, they are graded based on user-configurable design objectives.



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

Design for Six Sigma

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 response, and to characterize the statistical nature (mean, variance, range, distribution, etc.) of the responses of interest.

The variations in input parameters can be specified as exponential, Gumbel, normal, log normal, triangular, uniform, and Weibull distributions. Both random and descriptive sampling methods can be invoked. 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.

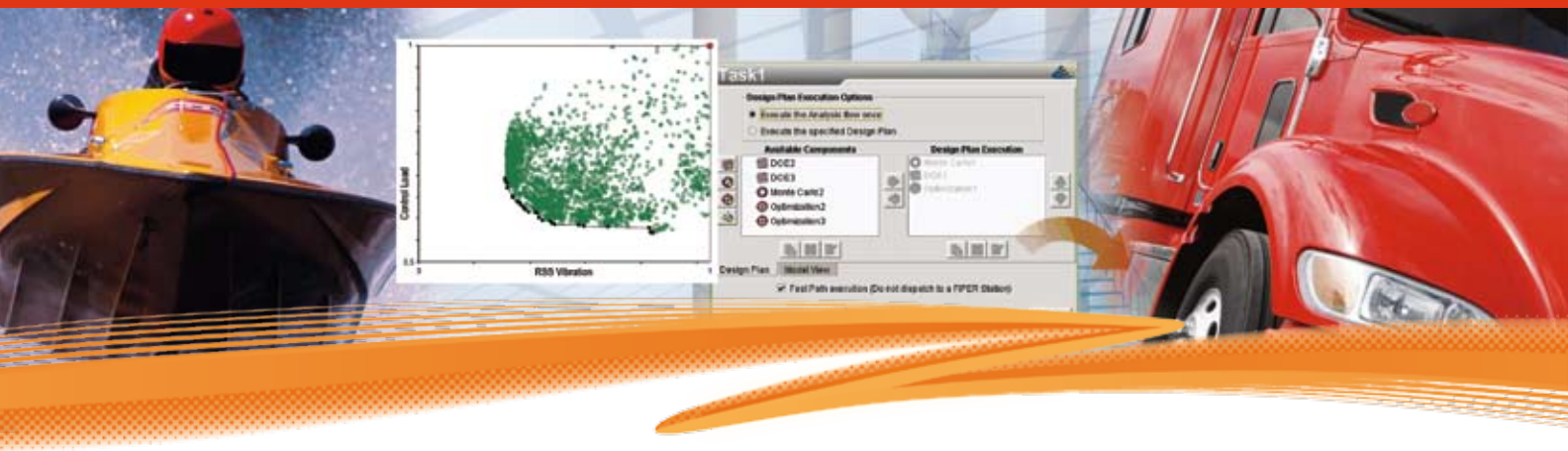
The Taguchi component can be used to improve the quality of a product or process by not only striving to achieve performance targets, but also minimizing performance variation.

Isight Used to Optimize Aircraft Engine Designs

Aircraft engines are complicated machines that involve many engineering disciplines, such as aerodynamics, heat transfer, structural analysis, combustion, rotor-dynamics, materials, vibration, and acoustics. They operate under conditions of extreme temperature, pressure, and stress, which put many of these disciplines in conflict. At the same time, customers demand highly efficient operation and long life with low maintenance costs.

Aircraft engine manufacturers use Isight extensively for integrating multi-disciplinary applications, such as CAD, FEA, CFD, and other programs, and automating the simulation process to perform trade-off studies.

By using Isight, engineers have achieved significant benefits such as increasing engine power while lowering turbine inlet temperature, reducing design cycles from two months to four days for airfoil shape optimization, and improving turbine efficiency while reducing weight and manufacturing costs.



Engineers Pinpoint Cause of Costly Refinery Shutdowns

An alliance of leading companies in the petroleum products industry needed to ascertain why certain operating conditions were triggering shutdowns in their lube/seal oil system auxiliary systems. During partial system shutdowns pressure valves were destroyed, leading to escalating costs in replacement parts and major losses in productivity.

Engineers knew they needed to meet minimum pressure requirements for both the lube header and governor trip. Time was of the essence. To arrive at an optimal pressure for both parts, engineers would need to quickly test hundreds of design alternatives.

The engineers adopted Isight to automate the design simulation process. They were able to use the application to simultaneously change the accumulator size and valve characteristics, allowing them to rapidly arrive at an ideal minimum pressure solution.

By using Isight, engineers were able to reduce the design time from two weeks to two hours, while dropping governor trip pressure by 28.7%.



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About SIMULIA

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