

Design for real

Optimus[®]

Identifying superior designs.
Building benchmark products.

Your parametric optimization rollercoaster.



Explore the design space
highly efficiently



Trace the best possible
design alternatives



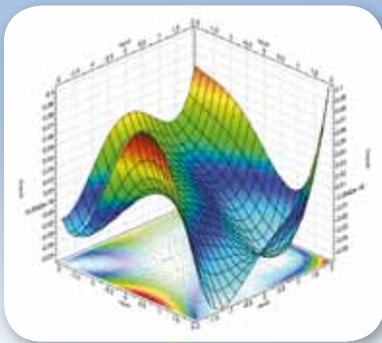
Design for robustness
and reliability

Explore the design space

in search of the best-performing design alternatives

Relentless computing power provided great reason to develop mathematical optimization methods to address problems that are too difficult for human beings to resolve. Optimus offers the unique capability to **capture your engineering process** and **orchestrate simulations fully automatically**. This means you can try out a new design option just by clicking a button.

Through design of experiments, Optimus is able to **virtually explore the entire design space up-front**. Insight into what's theoretically feasible in terms of product behavior yields **better-targeted manual design iterations**. An even better idea is to have Optimus **automatically manage and run the entire simulation campaign**. As this parametric optimization process delivers the best possible design alternatives, there's no comparison with traditional trial and error.

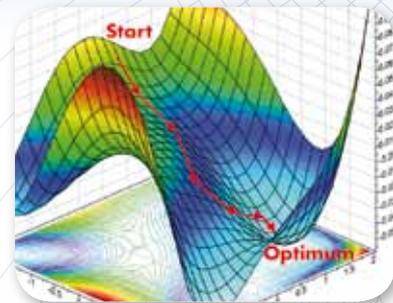


Unraveling the design space up-front

When targeting extreme product performance improvement, engineers require tools that help them **fully and rapidly understand the design space**. Optimus designs and executes a set of virtual experiments using specialized mathematical and statistical techniques. Design space exploration quickly results in a graphic 3D response surface model that highlights how to **take full advantage of the available design improvement potential**.

Numerical optimization vs. trial and error

While evaluating new design ideas, engineers struggle with conflicting objectives without really knowing what product performance is within reach. The parametric optimization process incorporated into Optimus adjusts the input variables of the simulation model to **identify the levels that achieve the best possible outcome**. Optimus' algorithms efficiently **deal with the most complex design challenges**, meeting your design criteria to the maximum extent.



Using Optimus, Snecma (Safran Group) realized a **2% efficiency increase of its HPC rotor blade aero-mechanical design process**. Keywords are multi-objective optimization and process automation.

A CFD engineering optimization project, at a leading German vehicle OEM, resulted in an **optimized diesel engine design** delivering **8% higher engine power**.

8%



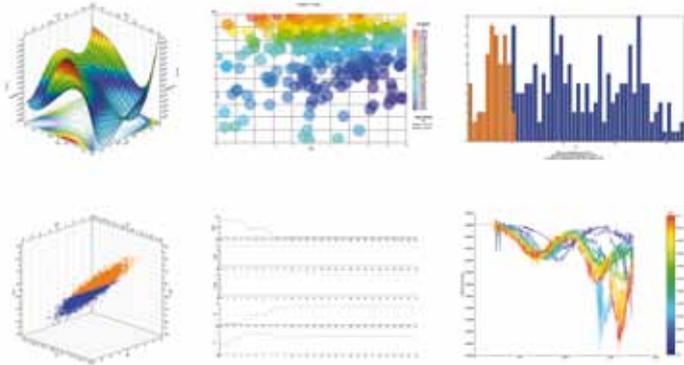
Fine-tuning the design model

Reliable simulation results require the comparison of component, subsystem and full-system models with **experimental data**, or alternatively the use of validated models of similar structures. Building and validating system models bottom up is the only valid approach to prevent accumulating inaccuracies. A **calibrated simulation model** allows you to **confidently fine-tune specific functional performance characteristics** of your product.



Results that speak for themselves

To quickly gain critical product development insight, Optimus offers practical **result processing and presentation tools** as well as extensive data exchange capabilities. Post-processing objects allow you to flexibly display graphic results generated by design exploration, optimization, robustness and reliability methods. A toolset including filters, custom tables, plots and statistical analyses help zoom in and **drill down to underlying data** to motivate a design decision, for example.



Optimus helps manufacturing companies resolve the toughest multi-disciplinary engineering challenges across a range of industries, including:

Aerospace | Automotive | Power generation | Electronics | Industrial equipment | Office equipment | Consumer good | Medical |

“ No matter how complex your product or process, Optimus design optimization software and services clearly set your company apart from competition. ”

Optimus realized a **16% reduction in stress peak values in steam turbine blades** from Skoda Power. The average stress in sensitive blade regions and the contact pressure between rotating parts also decreased.



Capture your process

to orchestrate your parametric simulation campaign

Today, virtual prototyping is widespread and the **benefits of integrating simulation into the engineering design process** are well known. The integration process is challenging for engineering and IT departments, as they are dealing with distributed teams, multi-disciplinary development and a mix of commercial and in-house developed simulation applications.

R&D centers perform better with **tightly integrated parametric modeling and simulation** managed by Optimus. Process optimization already pays off when **parametrizing a single internal or external simulation** application. Deeper integration levels cover **an entire workflow with multiple simulation applications**. The ultimate in integration is **having the entire process run automatically** in a high-performance computation center.



A workflow orchestrating your simulation tools

Optimus' intuitive drag-and-drop process editor **integrates and orchestrates any commercial or in-house developed simulation packages** that you use. Irrespective of engineering fields and programming languages, Optimus **implements the parameterization** and subsequently **automates design variable substitutions** to extract simulation results. Optimus bundles all information about the entire process workflow in a project, including simulation sequence/interfaces and related data files.

Parametrizing simulation workflows your way

Parameterizing a workflow takes only minutes with **Optimus' flexible and open methods**, and requires no programming skills. Simple drag-and-drop actions help you define design variables and design outputs that will become design parameters, objective and constraint functions. Besides rich standard parametrization methods, **user-customizable actions and interfaces (UCAs and UCIs)** offer **unlimited parametrization flexibility** and remove complex file syntax bottlenecks.



Optimus helped calibrate a high-performance John Deere Diesel engine using test data. **Automating nested engine performance and gas dynamics simulations** yielded a **faster process** and a **7.5% increase in global performance**.

7.5%



A leading German car maker executed its multi-disciplinary simulation process in **a computation center**. 80 computer processors completed **simulation in a fraction of the time**.

Simulation rollercoaster on single or parallel tracks

A very rich and powerful workflow execution mechanism is incorporated into Optimus. It's a simulation rollercoaster that transfers data automatically from one simulation to the next, regardless of process complexity. To speed up a workflow consisting of virtual experiments that are more time consuming, Optimus manages parallel execution on a array of CPUs.



Customized integration through plug-in framework

In addition to plug-ins released on a regular basis, Optimus offers plug-in framework tools for customized integration. To bridge the closed and rigid architectures of some CAE packages, UCAs and UCIs (see page 4) easily adapt to any simulation file syntax. Next to the process integration plug-in, Optimus offers plug-ins to customize response surface model approximation as well as design exploration and optimization.



For a high-end manufacturer of in-car electronics, Optimus helped reduce simulation preparation, execution and reporting from 8 to 3 days, resulting in a 166% time gain.

2.6x faster

Optimus incorporates direct drivers for many analysis programs, including:



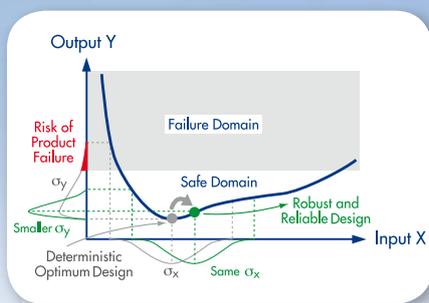
and many more. In addition, Noesis Solutions regularly adds drivers that interface with any other commercial or in-house developed programs.

Design for robustness and reliability

to ensure products last their entire lifecycle

In the real world, design input variables may shift slightly as a result of **manufacturing tolerances and geometric properties**, for example. Although the cumulation of these variations might seem negligible, it's often **the source of unexpected and unintended product behavior**. This explains why manufactured items of designs that successfully passed deterministic simulation sometimes fail.

Optimus searches the design space for design alternatives offering favorable performance that are **least sensitive to design input variability**. Robustness optimization clearly aims at assessing and controlling **frequent events that yield a minor performance loss**, whereas reliability optimization focuses on **rare or extreme events that yield catastrophic consequences**.

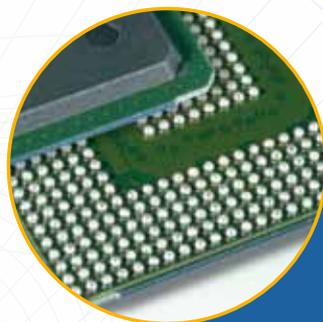
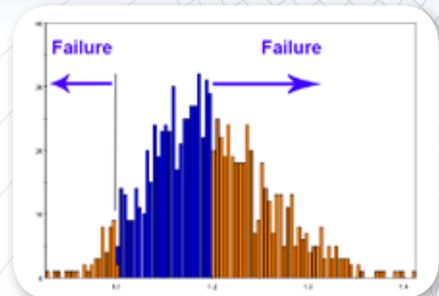


Why worry about design variability?

It's often more costly to control the causes of manufacturing variation than **making your process insensitive to these variations**. Going to market with a new product is **risky business when ignoring the influence of real-world conditions and uncertainties** related to functional performance characteristics. This generally leads to major financial implications and a bad market reputation.

Robustness-based design optimization

In the robust design optimization scheme, a measure for the robustness of the system or a component is considered as an optimization constraint or objective. As a result, the optimization strategy does not target the best possible performance, but **the best possible robust performance**. This optimal condition is robust to **small design changes**, so that **small perturbations of design parameters don't pull performance below the desired quality level**.



IMEC, a world-renowned nano-technology research organization, uses Optimus to **enhance electronic package designs**. So did the software help **extend solder joint fatigue life**, while **bringing design reliability above 99.7%**.

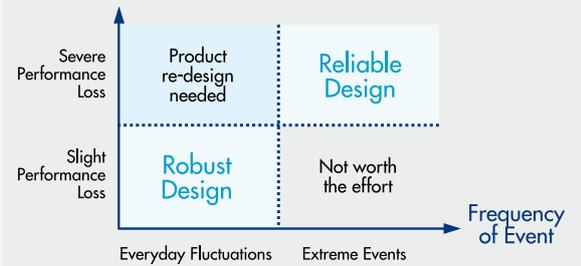
In co-operation with Centro Ricerche Fiat (CRF), engineers used Optimus to perfect a **sports car rear suspension design**. This helped establish a **50% reduction in toe and camber production variability**.

50%



Reliability-based design optimization

The optimization method for reliability is totally different than the one used to optimize robustness. **Optimus reaches highest reliability** by using the mean values of the random system parameters as design variables, and optimize the cost or objective function subject to prescribed probabilistic constraints. Non-linear mathematics identify **design alternatives that perform better, yet offering maximum confidence that major performance flaws will not occur.**



Taguchi Robust design

The aim of the Taguchi design is **making a product or process more stable in the face of variations over which we have little or no control.** A typical example is ensuring that a car engine will perform reliably under different ambient temperatures. Key in the Taguchi method is the distinction between control and noise factors. Optimus incorporates the Taguchi method through a **comprehensive user interface that controls a rich set of Taguchi methods.**

Optimus served as key component in redesigning A320 slat track for lower weight



ASCO, a world leader in aerospace devices, took part in a research project targeting the weight optimization of an Airbus A320 slat track, while keeping within preset life-time and safety margins. Pilots have slats slid out during takeoff and landing, to generate the necessary surplus lift force at lower aircraft speed.

Project engineers used Optimus to integrate durability simulations based on a detailed test-correlated FEM model derived from a CATIA V5 CAD model. Optimization runs orchestrated by Optimus identified design variants that potentially realized a 2% slat track weight reduction, providing tight design reliability guarantees at the same time.

99.7%

A Japanese printer manufacturer increased **printing performance and paper mechanism robustness** with Optimus, so that **paper jam probability reduced 5-fold** when feeding poor-quality paper in the tray.

5x

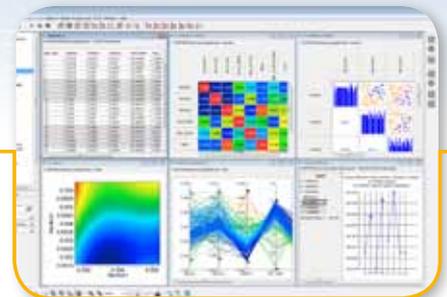


Noesis Solutions is an engineering innovation partner to manufacturers in **automotive, aerospace and other advanced engineering industries**. Specialized in simulation process integration and design optimization, the Noesis Solutions team focuses on resolving customers' toughest multi-disciplinary engineering challenges.

As one of the leading optimization software platforms in the world, Optimus couples optimization intelligence, efficiency and flexibility with ease of use. Optimus' legacy dates back to 1996 when Revision 1.0 was first shipped to customers. Now, after **more than twenty subsequent software releases**, many of the products that surround you have been optimized using Optimus.

Some customers use Optimus in larger deployments, many others have a single or multiple software seats that form an integral part of their product development process. **Optimus helps you make a habit of designing benchmark products without struggling with deadlines and budgets**. The streamlined approach results in higher margins, profits and market share.

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