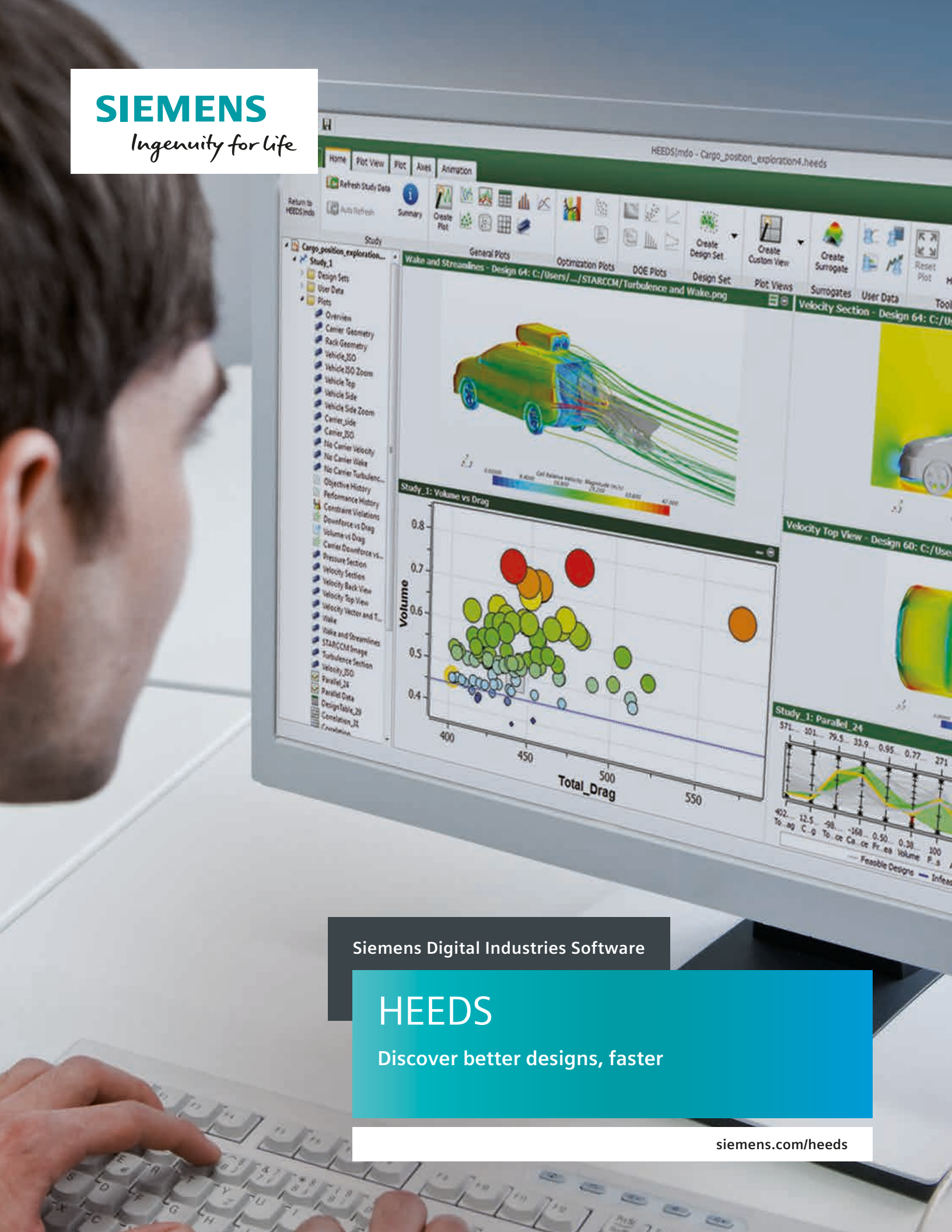
SIEMENS

Ingenuity for life



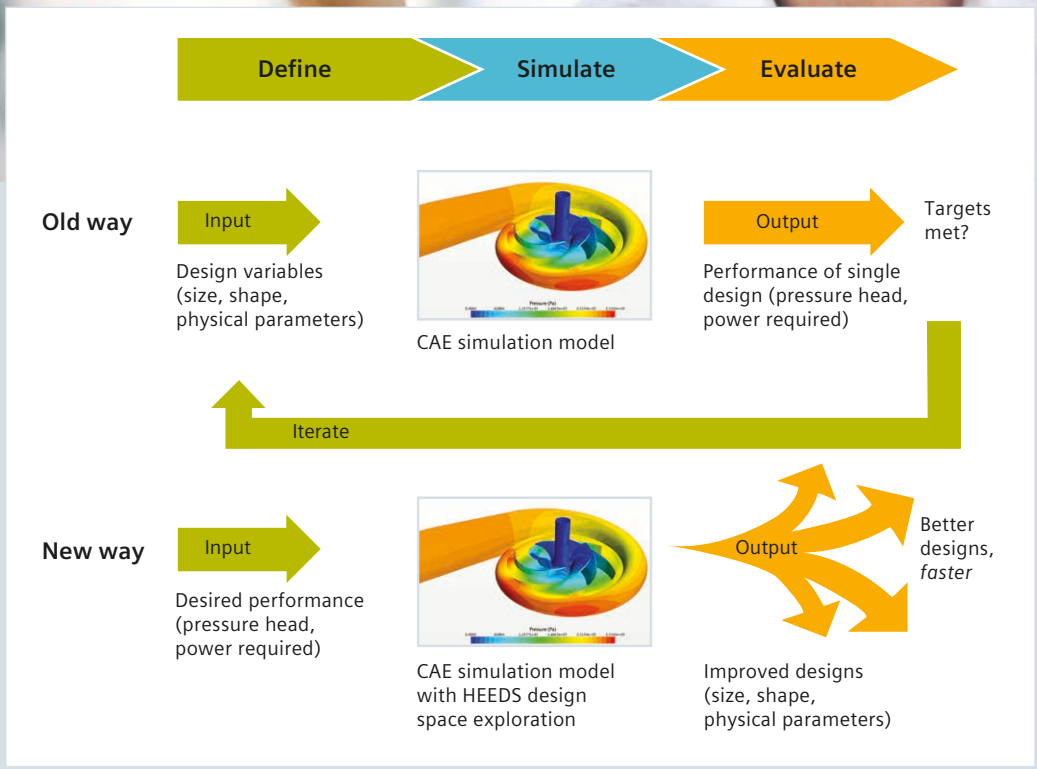
Siemens Digital Industries Software

HEEDS

Discover better designs, faster

siemens.com/heeds

Design space exploration helps engineers deliver superior performance



Are you using simulation to drive innovation?

Using HEEDS™ software allows you to do this by changing the paradigm. You no longer start with a design and use simulation to only evaluate performance. You can now define desired performance and allow HEEDS and your simulation tools to help you identify good designs.

Driving innovation through design space exploration

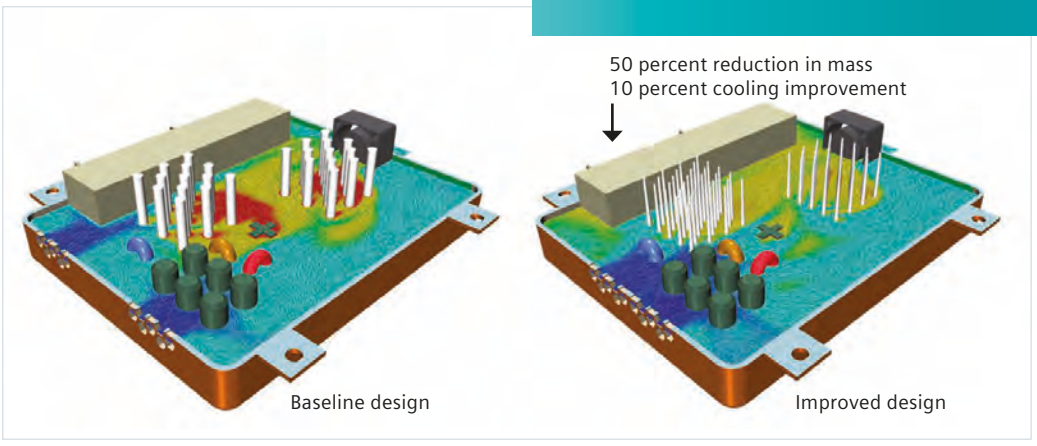
Modeling and simulation software provides an excellent way for designers and engineers to cost-effectively evaluate how their products will perform under expected operating conditions.

Design space exploration software takes modeling and simulation to the next level by allowing users to determine appropriate values of variables that yield product designs that result in exceptional performance.

Using HEEDS from Siemens Digital Industries Software simplifies the design space exploration process so all simulation engineers can discover better designs, faster. It helps unlock the full power of your computer-aided engineering (CAE) tools so you can move beyond troubleshooting and verifying designs and use simulation to drive innovation and performance.

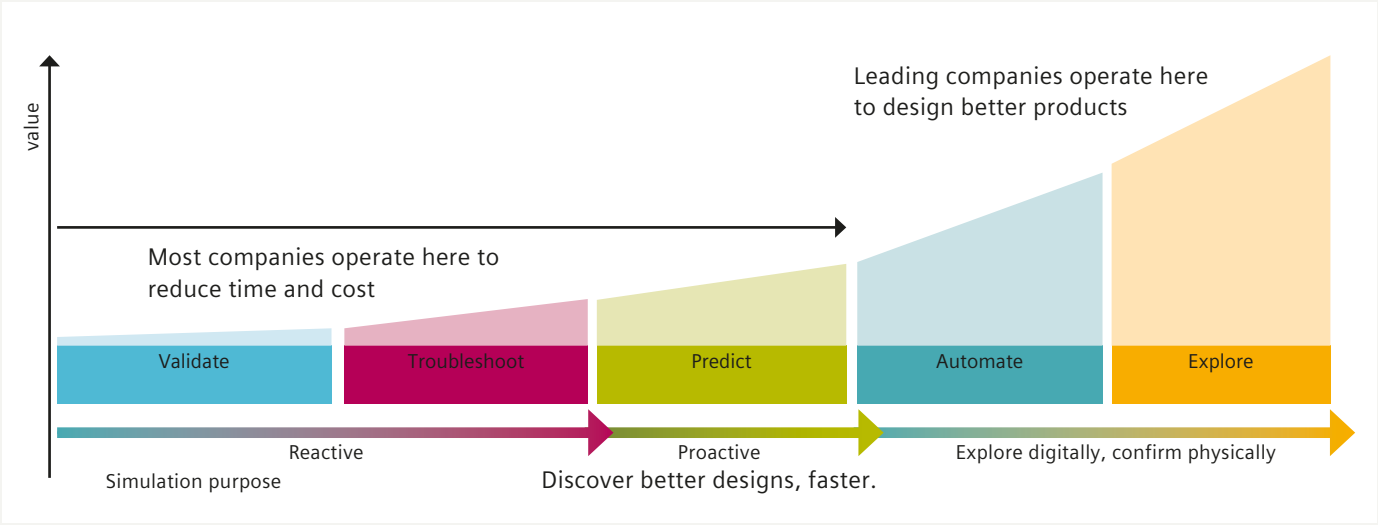
Taking virtual product development to the next level.

By starting with a standard CAE model of a computer case and using HEEDS, it took only two days and 50 cores to automatically evaluate 200 design configurations with different locations for the fan and vents as well as different size, shape, density and material for the heat sinks. In doing so, it identified a design that improved cooling performance by 10 percent and reduced heat sink mass by 50 percent over the baseline design. Better performance AND lower cost.



HEEDS helps you automatically find better designs.

Improving design performance



When companies strive to improve overall design performance, the challenge is often how to discover better designs, *faster*. Companies tend to spend most of their virtual prototyping efforts on building and testing simulation models to validate designs, and comparatively little time on exploring how to improve design performance. This scenario is true despite the fact that corporations acknowledge that enhanced simulation investment value may well be achieved if they have a more automated and efficient design space exploration approach. Imagine achieving better product designs faster with less testing or repetitive manual simulation work.

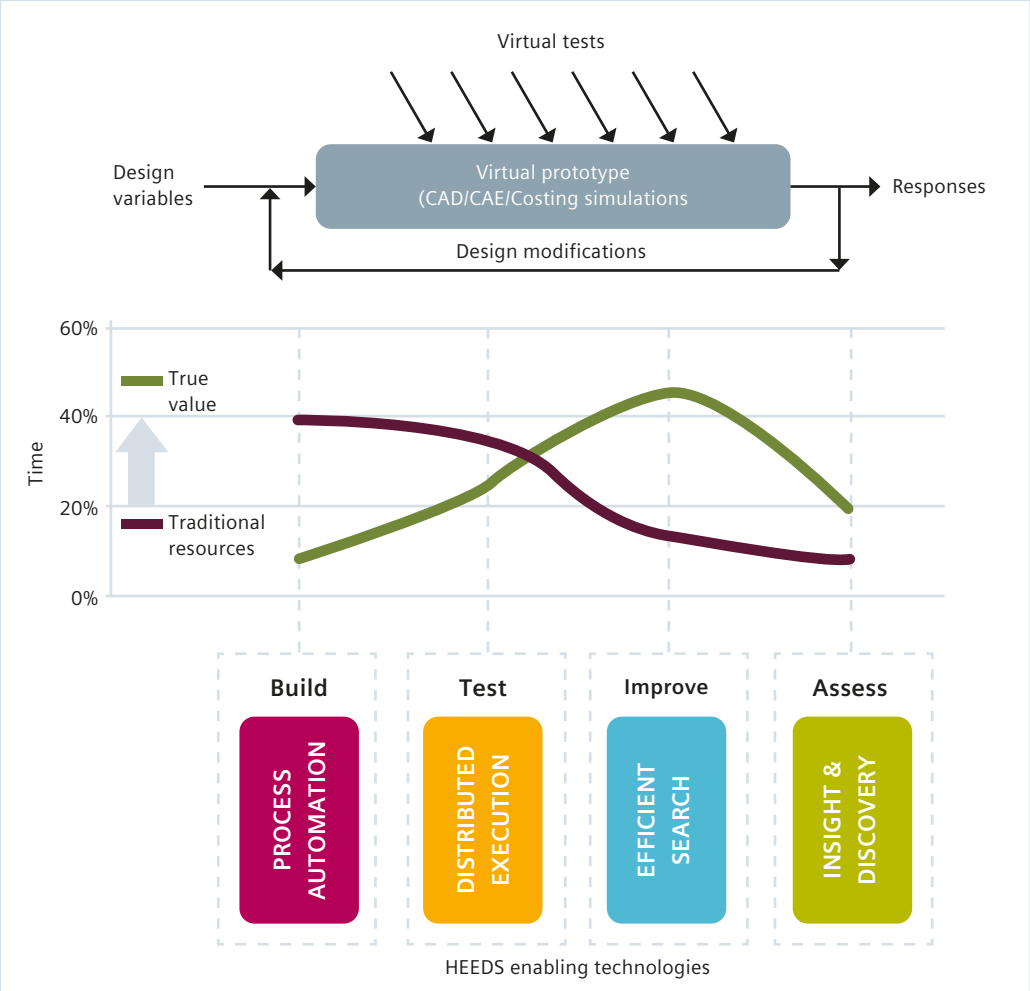
"HEEDS has been an indispensable tool for Trek to continue redefining the best-in-class products. Its algorithm has enabled us to explore the multimodal design space at unparalleled efficiency. Whether it's optimizing the stiffness, reducing aerodynamic drag, and/or fine tuning the weight, HEEDS can help Trek engineering to convert fresh ideas into the next generation products that maximize performance."

Mio Suzuki
Trek Bicycle Corporation

SPORTS

Streamlining virtual product development

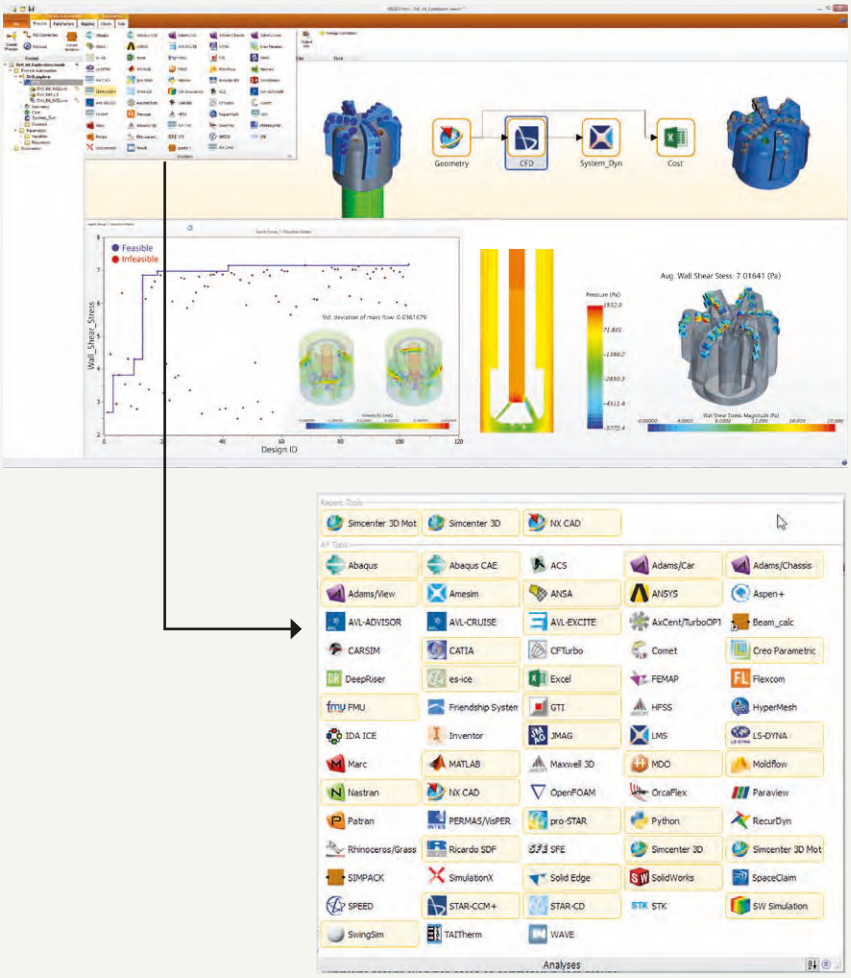
CAE tools are valuable for verifying product performance before manufacture or to troubleshoot problems in the field. However, the most significant potential benefit of simulation is through upfront design space exploration. Using HEEDS helps companies align re-sources with the value of simulation by providing four technology enablers for streamlining virtual product development, including: process automation; distributed execution; efficient search; and insight and discovery assessments.



Virtual prototyping process.

Traditional Virtual Prototyping requires too much time in building and testing models, and not enough time using simulation to find better designs. HEEDS changes that by providing four enabling technologies to streamline the Virtual Product Development process.

Process automation



Easily connect and interact with many commercial and internal software solutions.

In the virtual product development process, you can incorporate process automation technologies to help ensure the quality and consistency of your virtual prototype models. Using HEEDS software helps you automate and simplify virtual prototyping initiatives by allowing you to:

- Create process flows combining internal or commercial 1D, 2D and 3D simulation and cost-estimating tools
- Bi-directionally modify any native geometry
- Robustly re-mesh or update the simulation physics model
- Support co-simulation or sequential workflows
- Automate model rebuilding to explore a broad design space

It is common to use multiple modeling and simulation tools to test product performance, and often it is a time-consuming manual process to transfer data. By using HEEDS, you can easily define the design workflow and automatically share data between different modeling and simulation products. You can evaluate performance tradeoffs and design robustness, and focus on design selection versus design verification.

"The HEEDS implementation team and software platform enabled us to organize and process exceptional complexity and rapidly explore simulation data that will expand our possibilities and drive our decision making."

Michael Moreland
SEEDR L3C

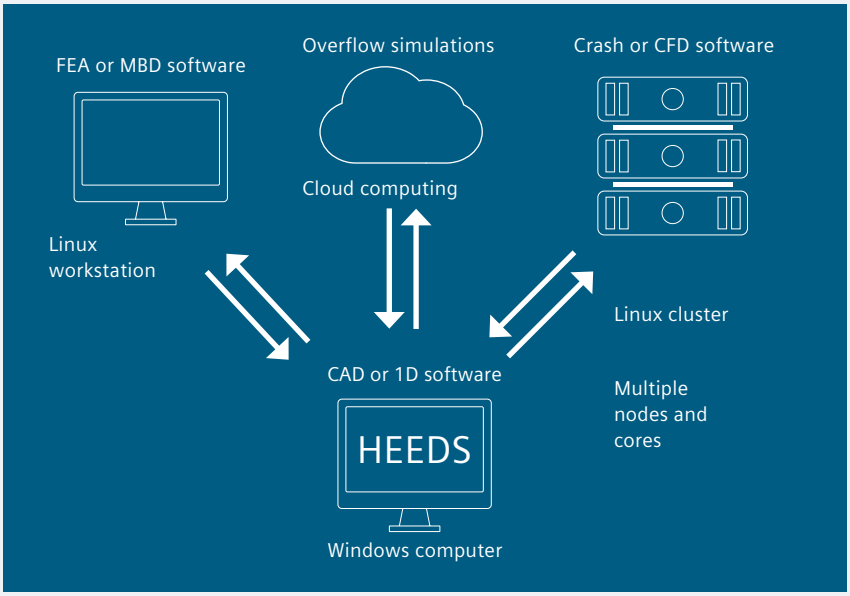
LIFE SCIENCES

Distributed execution

Using HEEDS provides you with transparent and automatic distributed execution functionality that helps you accelerate the process of testing virtual prototypes. Specific capabilities include the ability to:

- Leverage all available computing resources
- Reduce simulation turnaround with multiple levels of parallelization, such as workflow, tasks and cores
- Support unlimited load cases
- Orchestrate simulation tasks across platforms and operating systems
- Leverage efficient licensing schemes, high-performance computers (HPCs) and cloud resources
- Maximize your investment in virtual simulation with 24/7/365 run availability

By using HEEDS, you can effectively leverage your existing hardware investment as the solution allows efficient use of all your hardware resources, including local, remote, cluster and cloud computing. For example, you can automate geometry modifications on your laptop's Windows® operating system, perform a structural deformation simulation on a Linux server and a computational fluid dynamics (CFD) simulation on multiple cores of a Linux cluster. HEEDS can be used to orchestrate the entire distributed process and consolidate design space exploration results.



HEEDS takes maximum advantage of your available computational resources.

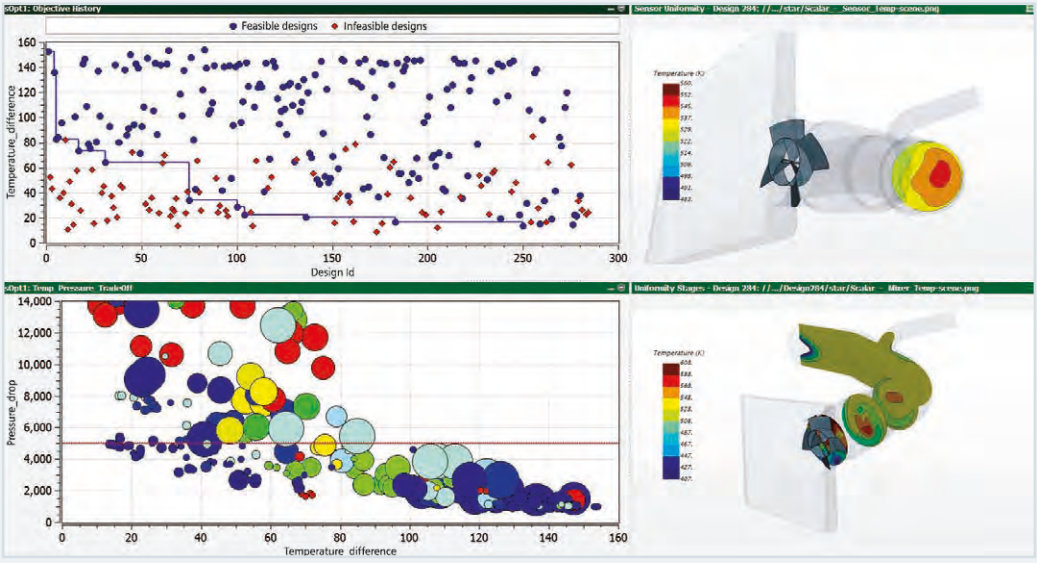
By using HEEDS, you can effectively leverage your existing hardware.

Efficient search

"Pratt & Miller has evaluated multiple design space exploration tools, and HEEDS, with its SHERPA algorithm, is the only one that can solve our highly constrained models."

Jesper Slattengren
Pratt & Miller Engineering

DEFENSE



Employing simultaneous search strategies to discover better designs, faster.

HEEDS includes proprietary design space exploration functionality that is used to simultaneously leverage multiple global and local search strategies, and adapt the search as it learns more about the design space. It requires no algorithmic search expertise on the part of the user, but easily incorporates user intuition through its collaborative search capabilities. This process allows you to identify higher-performing families of designs with minimal simulation time and cost. This approach, known as SHERPA:

- Requires no model simplification, model fitting or surrogates
- Uses hybrid, adaptive intelligent search to find better designs in fewer evaluations
- Helps you reduce search time, product development costs and product design risks

Most traditional design space exploration tools require highly specialized optimization skills and simplification of models to allow for efficient search. However, by using HEEDS, you can streamline design space exploration using your existing models no matter the complexity or number of parameters and constraints. Specify the time you are willing to wait for an answer, and the intelligent search functionality in SHERPA will help you adjust search strategies to find better design alternatives in the allotted time.

Insight and discovery

Using HEEDS gives you the ability to easily explore performance tradeoffs during the virtual prototype design process and effectively facilitate design reviews. By using the software, you can:

- Gain insight into product design alternatives
- Identify families of top-performing designs
- Indicate areas of cost-effective design changes
- Support design reviews by providing sensitivity to design variables
- Allow assessment of robustness to manufacturing tolerances

HEEDS provides users with the ability to easily compare performance over a wide spectrum of designs and find feasible design families that exhibit desirable characteristics and robustness. The software can help you understand design performance over any number of competing objectives and constraints.

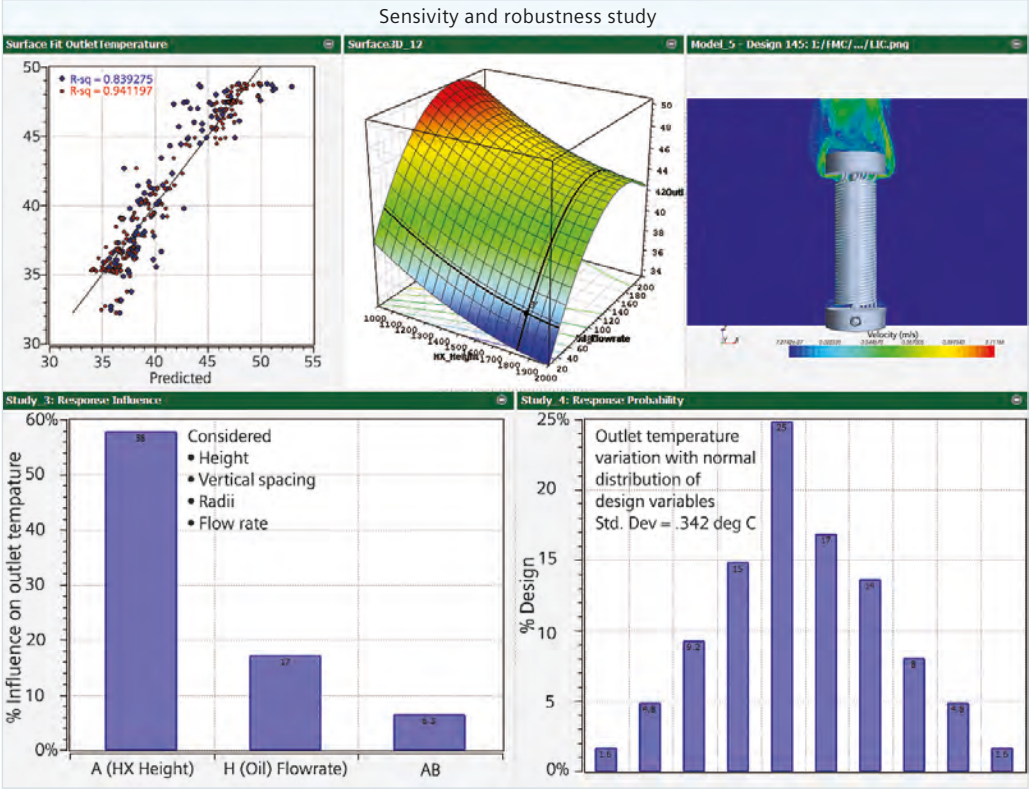
By using HEEDS, you can easily identify the sensitivity of selected designs to input variables so you can confidently make immediate design decisions during reviews and identify predicted results.

A HEEDS report allows you to review the effects of manufacturing tolerances and operating variances on product performance envelopes

"The capabilities inside of HEEDS give us a great advantage in understanding the characteristics of great appliance designs, and allow us to understand the effect of design concepts on product performance."

Stephen Smith
Electrolux

CONSUMER PRODUCTS



Exploring design tradeoffs.

Providing notable advantages

"Our conversations with customers have resulted in feedback like, 'Yes, we have an optimization tool, but we don't use it because it is too difficult.' HEEDS makes serious design space exploration available to engineers without requiring them to be optimization specialists."

David Ewbank
VI-grade Ltd.

MOTORSPORTS

Now your entire simulation team – not just your experts – can perform design space exploration and drive innovation. Take advantage of:

- Simpler process automation
- Faster simulation (testing) throughput
- More efficient search to identify better designs
- Easier design assessment

Using HEEDS can help you uncover new design concepts to improve products and significantly reduce development costs. The solution can be integrated with all popular computer-aided design (CAD) and CAE applications and works with multiple software tools to handle pre- and postprocessing, simulation and multidisciplinary design space exploration.

The HEEDS solution is particularly easy to use, allowing engineers with little design space exploration experience to quickly discover better designs. By using HEEDS, you can significantly reduce the number of model evaluations to identify better designs, often finding a solution in your first evaluation process. This efficiency can save days or even weeks of computing time during common engineering design space exploration studies.

HEEDS has been used successfully across many industries to:

- Improve design processes
- Increase customer satisfaction
- Reduce design time
- Lower prototyping costs and drive innovation

Providing support and services

We're here to help

Once you decide to use HEEDS to help drive innovation, Siemens Digital Industries Software is ready to guide you step-by-step through the process. Siemens Digital Industries Software can help you with software installation, training and mentoring. Our consulting services team can provide innovative solutions for your CAE modeling and simulation problems, design space exploration and application customization.

By taking advantage of Siemens Digital Industries Software's extensive experience and design space exploration technology, we can help you:

- Identify innovative solutions
- Generate more efficient designs
- Achieve significant productivity gains
- Attain a competitive market advantage
- Eliminate overhead

"We work with the HEEDS team because we benefit from their in-house engineering expertise, and we trust them to handle every project with the highest level of professionalism and quality."

Scott Wellman
NVH Solutions

AUTOMOTIVE

About Siemens Digital Industries Software
Siemens Digital Industries Software is driving transformation to enable a digital enterprise where engineering, manufacturing and electronics design meet tomorrow. Our solutions help companies of all sizes create and leverage digital twins that provide organizations with new insights, opportunities and levels of automation to drive innovation. For more information on Siemens Digital Industries Software products and services, visit siemens.com/software or follow us on LinkedIn, Twitter, Facebook and Instagram.
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Headquarters:	+1 972 987 3000
Americas:	+1 314 264 8499
Europe:	+44 (0) 1276 413200
Asia-Pacific:	+852 2230 3333

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