

PRESS RELEASE

Bringing clarity to product design

Interactive visualization accelerates product development

In product development, manufacturing and logistics, it is often not possible to achieve the same level of optimization for all target variables. However, support is now available to those responsible for reconciling the competing options, enabling them to more speedily identify the best compromise in the case of conflicting criteria and to communicate this in a clearly comprehensible way. The support comes in the form of “interactive visualization”. Fraunhofer IGD will be demonstrating its PAVED visualization solution at this year’s HANNOVER MESSE, taking product development of electric motors as an example.

Product development is gradually becoming more of a challenge as quality requirements increase and criteria such as sustainability and energy efficiency have to be factored in. With multidimensional, complex problems, there is often no apparent solution in which all the variables successfully attain their target value. Instead, there are a number of so-called “Pareto optimal” states, where one property of the product cannot be further improved without negatively impacting one or more of the others. Visualization software shows up the complex interaction between all parameters and features of a planned product. Working in close collaboration with the Linz Center of Mechatronics (LCM), the development team at Fraunhofer IGD have created PAVED (Pareto Front Visualization for Engineering Design). This interactive tool effectively visualizes correlations between individual criteria and thus provides a reliable basis for making decisions on how an alternative variant of a

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product might be designed. Clearly displayed and easy-to-understand comparisons also make it easier to coordinate planning with customers. In this way, visualization accelerates the entire product development process.

All product parameters in an interactive visualization

During the development phase of this software package, the team focus was on optimizing electric motors. Serving as the basis were the technical data and mathematical simulations supplied by their research partners in Linz. In fact, electric motors proved to be a good choice, because there are a great many adjusting screws that affect target variables such as efficiency, performance, smooth running and costs, an interplay that is not at all easy to grasp intuitively. PAVED visualization illustrates in the form of exact curve graphics how the individual parameters interact and what exactly happens when one of the values is tweaked. This can be done relatively easily by the manipulation of an infinitely variable slider. The software shows in real time how a changed value affects the other criteria in each case – in other words, the software plays out assorted “what-if” scenarios for the design variants. Conflicts of interest between individual values can be identified immediately. For example, if the desired motor output is increased, the costs also increase. In order to maintain an overview of the many possible design alternatives, a shortlist of individual variants can be defined in the software as favorites and highlighted in color, ensuring that these variants always remain visible in the display.

Visualization makes hidden connections apparent

The tool in no way replaces the know-how of experienced engineers. Rather, it supports them in applying their expertise and experience as efficiently as possible by allowing them to try out unconventional ideas directly on screen. “Here, it often comes down to nuances,” explains project manager Lena Cibulski. “A minor adjustment of a particular value – even if it’s just the wall thickness of the material at a certain point – can have an unpredictable effect on other parameters.” The visualization tool

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therefore also reveals hidden correlations that the experts had not foreseen.

Transparent communication of alternatives

Visualization not only helps with development work, it also supports presentations to customers or a company's management board, because it shows at a glance the options that are available to the developers. "There is no single best solution in this," says Cibulski. There are instead a number of design variants possible, each with different features and performance characteristics. The ultimate decision rests with senior management, depending on their priorities. The intuitive nature of the software also permits outsiders to acquire their own overview of the possible alternatives and the best possible compromise. The software can be operated locally or via the web. Customers or business partners only have to call up a link to get started, after which they can compare and evaluate all product variants for themselves. This facilitates communication and shortens decision-making paths. The added value can also benefit other industries. "Our software especially comes into its own wherever a great many design variants and sometimes incompatible quality criteria make compromise necessary," adds Cibulski. "For example, the planning of energy supply concepts for a building or the development of complex production facilities in a factory." And although PAVED was developed for engineering work, this type of visualization can also help other decision-makers in society and politics to weigh up consequences and achieve better outcomes.

Further information:

Hands-on: Try out visualization for yourself! www.fh-igd.de/Paved

More information on this and all other Fraunhofer IGD exhibits at HANNOVER MESSE can be found at: <https://fh-igd.de/HMI>

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About CloudiFacturing

The research work was funded by the EU CloudiFacturing project. The aim of the program is to optimize production processes using cloud/HPC-based modeling and simulation. The computationally intensive production engineering and simulation as well as data analysis tools are to be provided as cloud services to facilitate accessibility and make their use more affordable.

<https://www.cloudifactoring.eu/>

About the Linz Center of Mechatronics GmbH (LCM)

No fewer than 90 engineers at the Linz Center of Mechatronics GmbH are working on the mechatronic challenges of the future and providing the link between academic research and industrial application. In collaboration with the private sector, LCM makes new knowledge usable and supports customers in product development right through to the transition stage before series production. LCM offers a unique environment for creative and, at the same time, application-oriented research and development. Thanks to its ongoing participation in international research projects, LCM has built up a network of prominent international partner organizations.

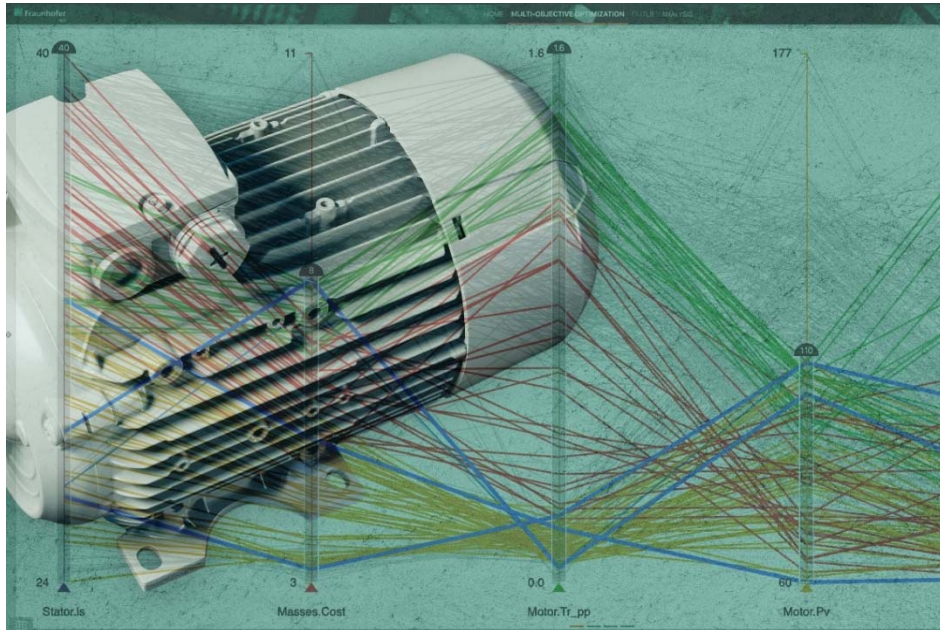
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Image: What requirements must the electric motor meet? Are there any parameters that can be marginalized to save costs? A neat and tidy visualization helps communication between designers, constructors and customers. (© Fraunhofer IGD/Linz Center of Mechatronics GmbH).

About Fraunhofer IGD

Founded in 1987, the Fraunhofer Institute for Computer Graphics Research IGD is the world's leading institute for applied research in visual computing—computer science based on images and 3D models. We turn information into images and images into information. Keywords are human-machine interaction, virtual and augmented reality, artificial intelligence, interactive simulation, modeling, 3D printing and 3D scanning. Around 180 researchers at three locations in Darmstadt, Rostock and Kiel in Germany develop new technology solutions and prototypes for industry 4.0, digital healthcare and the smart city. With an annual research volume of €21 million, we use applied research to help in the strategic development of industry and the economy.