

A BRAVE NEW WORLD

Thomas Nagel talks to Jonathan Rowland,
World Cement, about Claudius Peters' latest steps into
the digital revolution.

German-based manufacturer, Claudius Peters, was awarded the Innovator of the Year Award at Autodesk's Design and Manufacturing Awards, held at Autodesk University 2019 in Las Vegas. The award recognised the 113 year old company's use of Autodesk's generative design technology to optimise the design of a component within their clinker cooler.

Generative design

In contrast with traditional design, whereby a designer forms the idea in their mind and then transcribes that design into a CAD tool, generative design combines human design with the power of Cloud-based computing. It requires only that the designer initially specify a range of conditions before the generative design tool synthesises multiple solutions to those conditions. The human



designer can then select the solution that best suits their needs. In short, it provides algorithmic augmentation to human design.

The generative design process begins by defining the parameters within which the design must work. These include the following:

- ▶ Preserved geometries – the parts of the design that cannot change (for example,

because that is where the component to be designed will be attached to another component).

- ▶ Obstacles – for example, the areas required for access during manufacture.
- ▶ Loads and boundary conditions.
- ▶ Goals – for example, reduction of mass.
- ▶ Manufacturing criteria – the machines available to manufacture the design

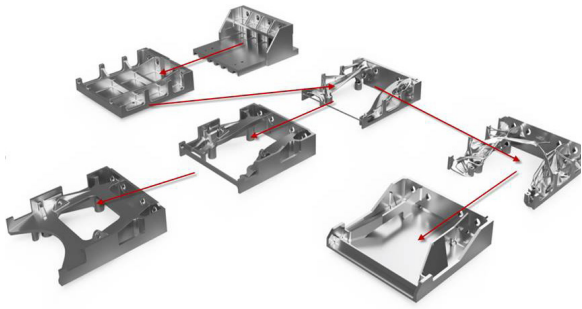


Figure 1. The evolution of a product.

(currently only additive manufacturing/3D printing and 3-axis and 5-axis CNC milling are supported).

When these conditions have been input and uploaded to the Cloud, the generative design tool synthesises a range of design options that fulfil the criteria. The human designer is then able to filter these (for example, based on cost or time to manufacture) to find the optimal solution.

In Claudius Peters' case, as the company still uses traditional manufacturing methods, the generative design process enabled the company to design an optimal component (which its design team referred to as the 'alien' part) that it could use as a model on which to base a design that was able to be made using the company's manufacturing facilities.

"This year, Autodesk really emphasised their generative design process, which they started talking about a couple years ago," explained Thomas Nagel, Chief Digital Officer at Claudius Peters. "I was sceptical then, but now you can use the software workflow to determine what your manufacturing process will be and the generative design follows suit. It's a new era when generative design really takes hold, and everything is designed to be the lightest, strongest, and most efficient it can possibly be."

Claudius Peters and generative design

"When we started with the idea, I had the idea to optimise large components and the plant completely," continued Nagel. "Last year, our digital team began experimenting with Autodesk's generative design technology. We chose a just-optimised part ('transport bottom, front part'), of which there are many inside the clinker cooler, for the first application because saving material is an important cost factor for this heavy, cast part. We developed an evolution story for that part. Coming from 168 kg in 2016, we took this part and used different strategies. The evolution can be seen in Figure 1. The prototype stands at the moment at 52 kg."

"We were thus able to save 25% on the weight on our prototype. At the moment we are still working on the final design of our new ETA lane design. We are planning to go into production in 3Q19. The savings are about producing maybe 60-times or 100-times 'transport bottom, front part' per cooler, with about 20 kg less weight."

More widely, Claudius Peters' engineers are now able to use a new technology to find new solutions in a very traditional industry. "After only a few hours of work we had a completely new part," explained Nagel.

Digital transformation: an attitude not a project

Claudius Peters began its 'Innovation Journey' five years ago, calling the project 'Inspired Excellence'.

"Modern designers and engineers must adapt to modern ways," said Nagel. "Increasingly, they have to understand themselves as a data manager and programmer. Modern design and engineering work requires a complete new set of digital skills. Not everybody is already on board. But we try to convince them that we have to change to avoid extinction."

According to Nagel, digital transformation is not a project, it is an inner attitude. "This means that it is mainly a people change and not a technology change. We must convert to an agile company to cope with the fast changing world and market requirements. We have started already with agile project and product management. We already have nine certified Professional Scrum Masters in our team."

The idea of digital transformation as an attitude and not a project is the first of five critical steps on Claudius Peters' path to innovations excellence that Nagel recently outlined in an interview with Redshift by Autodesk.¹ "Change is like swimming," Nagel said. "You train, you exercise, and eventually you like it. It's the same with change management. You have to understand that change is not pain; you have to exercise it, and then it becomes fun."

The next step is to empower change agents, who are responsible for their product's innovation and then promoting its adoption at the company. These 'Agile Agents', as Claudius Peters refers to them, are empowered to "just do things, develop things", Nagel explained. And this change does not have to be driven by an immediate return on investment: "We often do not make a return-on-investment calculation before we start," he says. "We just do it."

The third step on the innovation pathway is to leverage the ingenuity of students.

At Claudius Peters, student interns can play a crucial part in product innovation, sometimes even solving problems that experienced engineers have not been able to. As Nagel put it, “They are used to learning, to seeing something they do not know and digging into it.”

As well as incorporating a new generation of innovators into the development process, Claudius Peters works with new tools and technologies (step number four) of which generative design is a prime example. The company is also experimenting with computational fluid dynamics to optimise pressure drop and thus optimise power usage. Ultimately, this may result in solutions that are not compatible with legacy technologies: a fact that Nagel is not afraid of. After all, “the invention of the electric light was not an improvement of the candle.”

Nagel’s final step is to make sure innovation keeps in mind the needs and values of customers. As an example, he points to the development of the ETA cooler, which was released in 2003.

“We have to take care of our resources and optimise, let’s say, energy consumption,” Nagel concluded. “So we developed things like the ETA cooler. It has an outstanding thermal efficiency and recovers a lot of heat that you can use in your kiln to reduce the fuel consumption. This is a huge benefit; it is good and correct to be careful with resources. For a customer who is saving money on power and/or fuel consumption, it is also a huge benefit. Our customers have big sustainability goals, and it helps if you can show that your technologies can be a part of that.”

Conclusion

Ultimately, Claudius Peters’ digital transformation has been underpinned by the following values:

- ▶ Redefining the cooperation with customers.
- ▶ Steering the company’s focus from the product to new services.
- ▶ Solving new problems with new technologies.
- ▶ Accepting that yesterday’s knowledge provides few answers to the questions of today and tomorrow.
- ▶ Allowing new ways of thinking, structures, and communications.
- ▶ Allowing cultural changes, to become an agile company in all areas.

“We think that we have to understand the meaning of networked data, network organisations, and not working in silos and hierarchies,” concluded Nagel.

“Developing faster, failing, and learning faster; developing the digital twin and using it from the beginning; working with more agility, less with waterfall planning; and cooperating with customers, partners and suppliers at a very early stage.” ■

References

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Further information

Autodesk University Las Vegas 2018 Product Design & Manufacturing Keynote

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Claudius Peters SMART SOLUTIONS

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