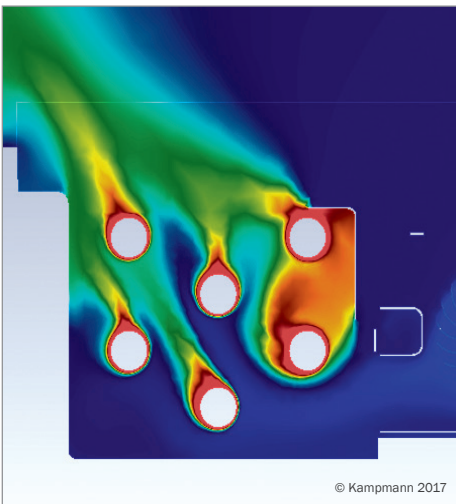


Better Indoor Climate thanks to Simulation and Optimization



Key Highlights

Industry

Heating, Ventilation and Air Conditioning (HVAC)

Challenge

Reduction of physical prototypes and early insights into system performance via virtual development approach

Altair Solution

CFD-Simulation with AcuSolve, Optimization with OptiStruct, Mesh-Morphing with HyperWorks

Benefits

- Less physical prototypes
- Shortened development circle
- Detailed insights into system performance
- Improved customer communication through visualization of system details

Simulation and optimization bring fresh air and improved performance to Kampmann's climate-controlling machinery. Air-conditioners are used to achieve desired indoor climate conditions, adjusting temperature, humidity, air purity or air movement as required. In addition to pure functionality, criteria such as noise and energy consumption are also important when it comes to choosing and designing air-conditioning systems.

Whether climate control devices are used in a car, ship, plane or building, they have to be customized to the needs of each customer and individual environment. Depending on the project, individual design adjustments may be needed, which have to be tested and approved on site. Simulation can be a big help here, especially when it comes to testing functionality and special requirements prior to production.

With simulation, insights into the system's behavior enable designers and engineers to make development decisions at a very early stage of a project. Along with classical design and simulation tools such as CAD or Finite Element Analysis (FEA), additional tools covering computational fluid dynamics (CFD) and plant control device simulation are beneficial in the development of climate control systems.

Kampmann GmbH is an internationally leading specialist for heating, cooling, air-conditioning and integrated building automation. The company employs more than 720 people at 14 locations all over the world. Traditionally, Kampmann's expertise is in series production, offering a broad range of system variants and appealing solutions that are project-based and individually customized.

Kampmann Customer Story

“Without a doubt we can say that the information depth we reached within only two months of applying simulation is above the insights we gathered years ago in a cumbersome design process. This means we saved a lot of time. Furthermore we now know why some of our initial ideas did not work. In this way we were able to completely focus on target-oriented improvements. In one use case we were even able to reduce the construction height of the plant by more than 15 percent, which is an enormous advantage for our customers.”

Dr. Oliver Höfert,

Development Department, Kampmann GmbH.

The flagship products of the company are KaTherm HK, a trench unit, and KaDeck, a ceiling system for heating and cooling.

Kampmann began using simulation in its development process a year ago and is already reaping the benefits. Before simulation was used, the air-conditioning systems were tested physically, which meant much longer development time requiring greater effort.

Within its virtual development process, Kampmann is using the Altair HyperWorks® software suite, in particular AcuSolve®, the CFD solver; OptiStruct®, the suite's FE-solver

and an optimization tool; and HyperMesh® for modeling and meshing tasks. For plant control design, Kampmann is currently considering solidThinking Activate®, a mapping software for control systems.

Thanks to simulation, Kampmann engineers are now able to answer questions regarding the internal processes of the system, which are difficult, if not impossible, to study through physical testing.

Existing Process

Whenever Kampmann has to deal with a special project, each solution is customized and optimized for its intended use case.

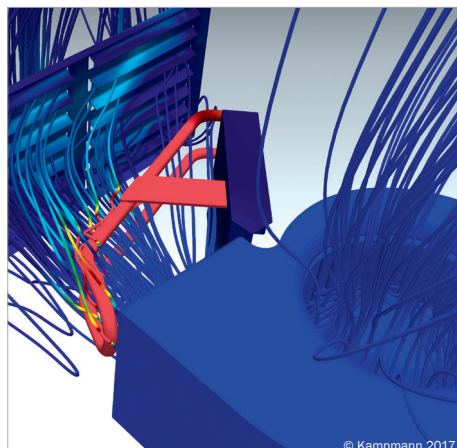
Often the customer has special requirements, for example, a room that needs a pre-determined air stream in order to achieve satisfactory air distribution.

Because Kampmann has a vast library of CAD models at its disposal, designers can often rely on existing geometry data to develop base simulation models and then customize each system as needed. Simulation makes it possible to test multiple variants and optimize the system, so the perfect solution for each customer can be designed. After final physical testing, the design can be approved by the customer on site.



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The floor-built air-conditioning system KaTherm HK seamlessly blends into the interior design



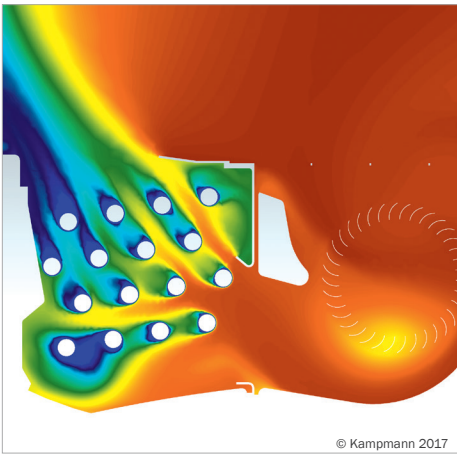
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The visualization of the flowlines helps finding the ideal result and discussing design alternatives with customers

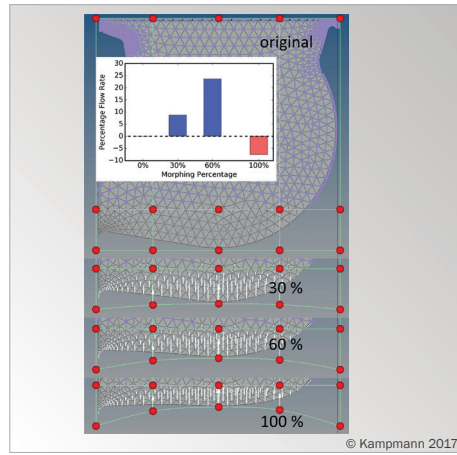


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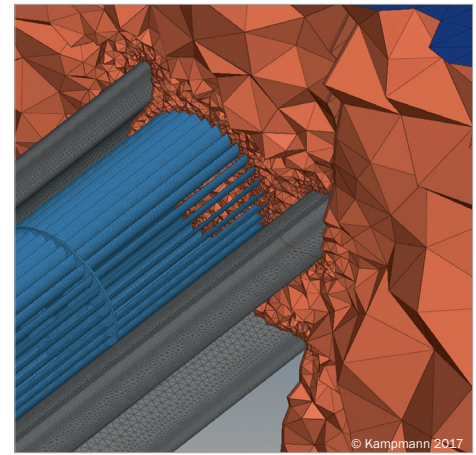
Streamlined visualization of a floor-channel-system. For a good distribution warm air should be conducted along the storefront.



Thanks to simulation the dimensions of the heat exchanger could be reduced by 50%.



Analysis of different fan variants using the HyperWorks Mesh-Morphing application in order to improve airflow.



To create simulation models Kampmann used existing geometry data

Use Case in Floor Built Air-conditioning Plant

During a recent project, Kampmann engineers had to further optimize the trench heating/cooling system Katherm HK. The Kampmann team analyzed the existing system and did a design study using simulation to improve the system's performance (flow rate) and noise behavior. After creating a simulation model based on CAD data, they then analyzed different variants of the air baffles, heat exchangers, and fan systems. When it came to deciding which design variants would be the most promising, it was especially helpful to be able to visualize the air flow. The engineers simulated six design variants, of which the three most promising were then built as prototypes and physically tested.

Since each test of one device takes two to three days, the simulation-based pre-selection of the systems helped the Kampmann engineers shorten testing time by an entire week. In the end, they realized that each design variant had its own disadvantages, and based on performance, the original system was already designed very well. Hence the team turned back to the original design, but used the new simulation-based knowledge to reduce the material needed for the heat exchanger. The new heat exchanger was only half the size of the previous model but still offered satisfying results, so the design could then be realized at significantly lower costs. After this development step, the engineers also looked at different fan variants to further improve the airflow within the system. This was handled with the mesh-morphing function of

HyperWorks. Again, the engineers were able to choose the best variant based on the simulation results, which was later verified by measurements.

Advantages

The use of simulation benefits Kampmann engineers in various ways. One of the major advantages simulation offers is a deep insight into the system's behavior, helping them to better understand the correlations within the system and to identify and implement means to improve the system. These targeted design changes and analyses had to be physically tested before simulation came into play. Once a design variant has been identified, physical testing can be reduced to a minimum of prototypes. This helps to streamline the development process and to make it more flexible. By means of CFD simulation with AcuSolve air flows can be visualized, which helps the engineers to get a deeper understanding of the system and lets them discuss the results directly with the customer to agree on needed changes and improvements.

When development at Kampmann was mainly dominated by physical testing, CFD simulations were done in part by external consultants, and it took about 10 days for Kampmann to receive the results. Today the Kampmann engineers do the same job in-house with AcuSolve in only about 3 hours. This reduction of the calculation time enables Kampmann to investigate more variants in the given time, which helps to better understand and improve the systems accordingly.

Kampmann decided to use the Altair HyperWorks units system for their licensing. With the units, the developers can access all solutions from the HyperWorks suite as well as all Altair Partner Alliance software without any additional costs. New software tools can be easily tested and even only sporadic simulation tasks can be executed with the appropriate tool at no additional cost.

Outlook

The use of simulation at Kampmann will certainly increase in the future and expand to include applications which are not yet covered today. The developers at Kampmann have already tested solidThinking Activate software to investigate the vibration behavior of a cross-flow fan and to compare the results with physical acoustic measurements. solidThinking Activate is available via the HyperWorks licensing system and can therefore be used very flexibly, depending on the needs of the engineers. With a tool such as solidThinking Activate, it is possible to gain insights into the correlation between the system and its controllers and to quickly take appropriate measures to improve the system. As Kampmann's simulation-driven development process evolves, automation of standard tasks will play a bigger role in the model creation process, again reducing time and effort. With optimized CAE models in place, fewer design iterations will be needed, putting Kampmann's engineers much closer to the final solution, right from the start.

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About Altair

Altair is focused on the development and broad application of simulation technology to synthesize and optimize designs, processes and decisions for improved business performance. Privately held with more than 2,600 employees, Altair is headquartered in Troy, Michigan, USA and operates more than 68 offices throughout 24 countries. Today, Altair serves more than 5,000 corporate clients across broad industry segments.

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About HyperWorks

HyperWorks is the most comprehensive open-architecture simulation platform, offering technologies to design and optimize high performance, efficient and innovative products. HyperWorks includes modeling, analysis and optimization for structures, fluids, multi-body dynamics, electromagnetics and antenna placement, model-based development, and multiphysics. Users have full access to a wide suite of design, engineering, visualization, and data management solutions from Altair and its technology partners.

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