Making Light Work of Lifting

Liebherr-Werk Nenzing GmbH use FloEFD™ for Creo™ in their Mobile Harbor Crane Designs

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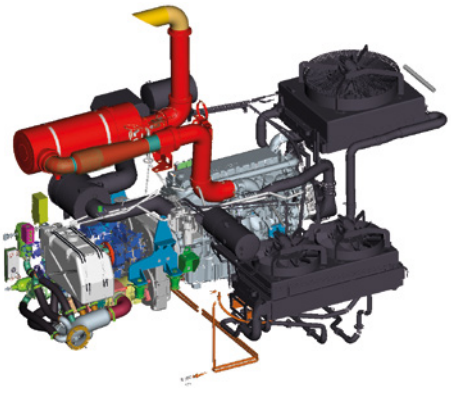
Liebherr Werk-Nenzing GmbH, manufacturer of maritime cranes, crawler cranes and foundation equipment, demonstrates the importance of modern "Frontloading" simulation tools which go far beyond classic FEA-Analysis within the heavy duty industry.

From your experience how is the heavy duty simulation world doing at present?
The simulation world is more than ever dominated by strict regulation due to emissions, performance and comfort. It has become more and more important over the years to think beyond the classic FEA-Analysis, which most people immediately associate with our industry and applications.

Recognizing the potential for FEA-Analysis, how does CFD fit?
From a simple hydraulic block to a full power pack there is an almost infinite number of tasks waiting to be analyzed. The large number of potential cases which might consume needless power has been realised over the past years. However, external simulation services to solve this soon turned out to not be efficient enough and too expensive. At Liebherr we have high standards, so finding the tools to meet them was not an easy process and took a long time.

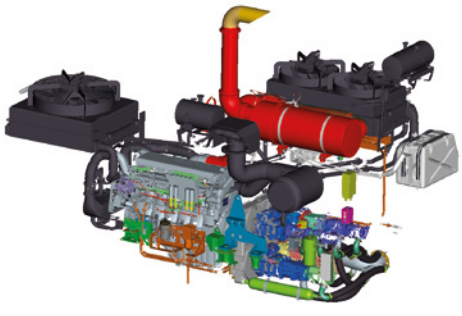
Why was FloEFD chosen?
As a company we were aware of FloEFD™ and indeed the concurrent approach of the technology. The over-riding reason was the strong pre-&post processor in combination with the efficient meshing. Alongside the advantage of full CAD-integration into our CREO environment, allowing quick analysis of full power packs in our own CAD system. This gives me the ability to analyze more projects at the same time, something competitors are not able to achieve.

How does FloEFD help with the complex structure of power packs?
Power packs basically contain everything below the engine hood, and typically include many devices such as cooler (diesel, water, air and oil), fans, exhausts, and hydraulics. This means that our CAD models can be rather large, with up to tens of thousands of components including all screws.

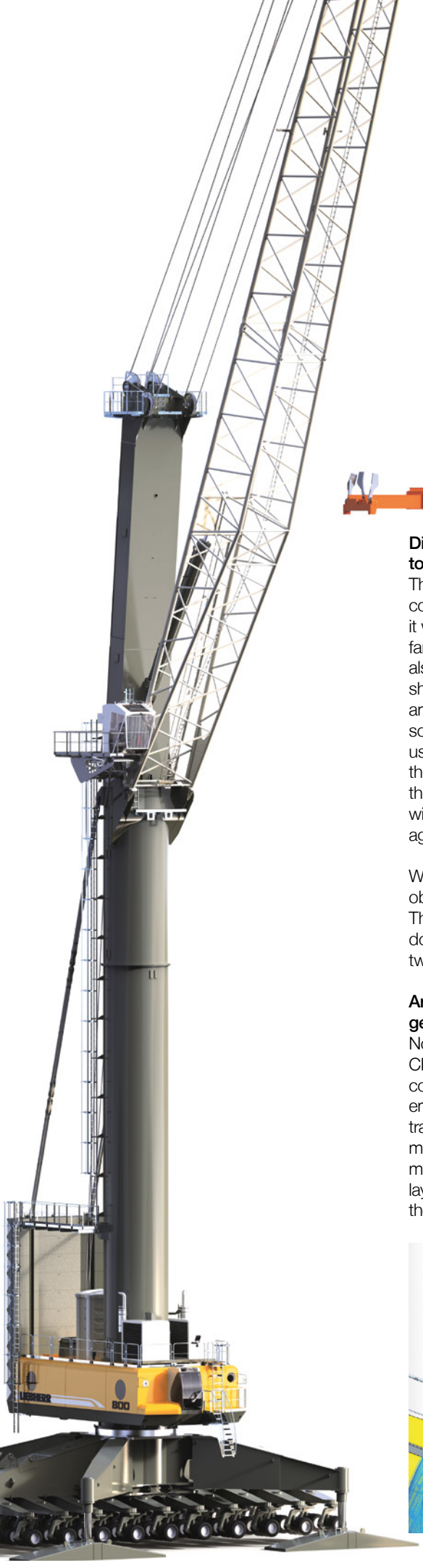


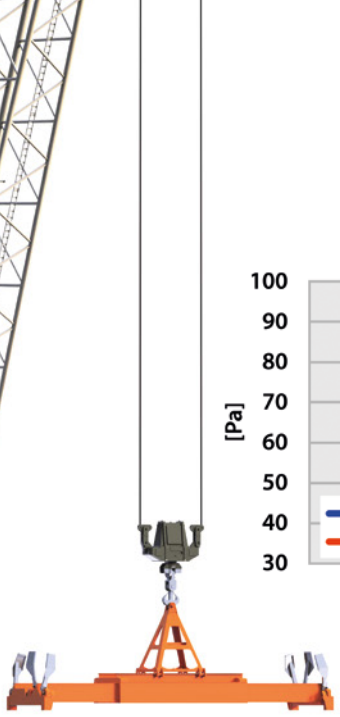
The requirements on the CFD software are therefore tough and it became apparent that most commercially available codes were not able to handle this kind of complexity, hence our need to turn to FloEFD.

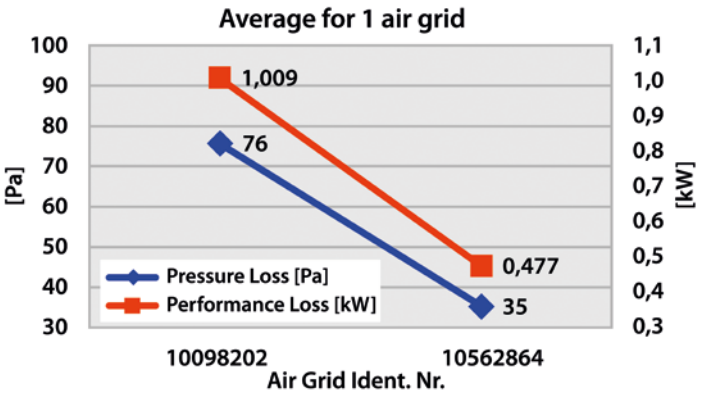
The whole development cycle is influenced by this and the flexibility FloEFD allows, means that I can make decisions before, and not after, when it is too late.



There are many examples, a practical example of how FloEFD has helped with our mobile harbor crane, the LHM 550 and the inlet section of the power pack. I wanted to look at the efficiency and optimization of the protective grids. The basic inlet hood contains two rows of baffles to avoid unwanted particles such as dust or rain being inhaled by the engine. On the other hand, a set of baffles means that we have a potential performance loss between the environment and the engine. The idea is that we can save energy when we reduce the resistance.



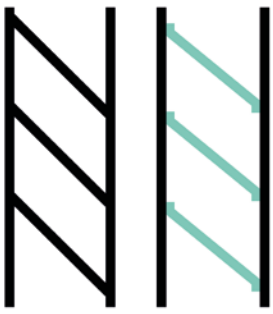




Did you use the full CAD-crane model to set up the FloEFD project?
Theoretically with FloEFD we could, but in this context it was not required. For the first step it was sufficient to have the coolers with two fans and the grids. The exhaust system was also integrated to see thermal effects near the sheet metal walls. We soon realized that the angular position of the baffles was not optimal, so we needed to locate the optimum. We used FloEFD's parametric study feature to let the software find the best angle position with the lowest pressure loss. However, always with respect to an acceptable protection against particles.

We also removed the middle beam which obviously represents a barrier for the airflow. The whole process including meetings, documentation, and decision-making, took two working days.

Are you experienced in transferring such geometry and generating the mesh?
No, not really. However, unlike the other CFD tools I experienced, FloEFD follows a completely different approach by being CAD embedded which allows me to fully skip the transferring geometry step. With regard to the mesh, people typically struggle with body fitted meshes and its manual creation of boundary layers etc. Indeed it takes much less time for the mesh generation compared to classic



CFD-approaches. It saves us not just hours or days but weeks, this in turns gives us the benefit of not only saving time but money too. The amount we save with the reduction of man-hours spent on the project can be easily put into numbers. Not to mention the manufacturing cost savings per unit and year.

The target of increasing the performance and reducing emissions was achieved. A very welcome side-effect was that we automatically improved and simplified our manufacturing process which saves further costs. We now glue the baffles onto the frame instead of welding them.

Did you face any problems following this change in design?
We didn't face any real problems, other than the assembly team told us that removing the beam from the middle results in one single baffle for each row, instead of the initial two, so now the team has to carry double the weight while mounting.