Liebherr Group

Using Simcenter solutions enables heavy equipment manufacturer to avoid developing costly physical prototypes

Product
Simcenter

Business challenges
Reduce cycle time for building a 144-ton hydraulic excavator
Develop a hydraulic excavator without a physical prototype
Optimize design to avoid durability and resistance issues

Keys to success
Use Simcenter Amesim and LMS Virtual.Lab Motion
Simulate several system versions, including diverse mechanical systems

Results
Analyzed behavior of subsystem without building expensive prototype
Determined best possible design to avoid backlash and reliability issues
Saved time and money, helping to maintain Liebherr’s strong competitiveness

Liebherr Group maintains its strong competitiveness by leveraging Siemens PLM Software solutions

Reducing development time
Efficiency, durability and sustainability aren’t just relevant engineering topics in the automotive sector. World leaders in the booming construction and heavy machinery segment, such as Liebherr Hydraulic Excavators GmbH, understand the brand value of innovation, quality and economical design as well.

How do you save time building a complex 144-ton hydraulic excavator without compromising one iota of quality? By using Simcenter™ solutions for co-simulation from Siemens PLM Software.

Established as a family business in 1949 by Hans Liebherr, the Liebherr Group (Liebherr) has grown into a multinational organization, employing more than 38,000 people in over 130 companies throughout the world. The story began with easy-to-assemble and affordable tower cranes. Soon Liebherr expanded its business to other fields, ranging from domestic applications to port equipment and aerospace. Today, Liebherr is known as one of the world’s leading manufacturers of construction machinery, providing innovative products and services to a variety of heavy-duty industries.

To maintain its strong competitiveness, Liebherr needs to continually innovate.

Customers are typically conscientious about reducing fuel consumption and adhering to strict emission legislation. They are putting their purchasing power behind equipment that gets the job done in an environmentally sustainable manner. Liebherr also knows that it needs to
shorten its development time to be first to the market with the best product. This has inspired the company to seek out new ways to design and develop increasingly efficient and durable machinery.

**Evaluating the options**

This was especially relevant for the development of 144-ton hydraulic excavator known as the LH 120 C Litronic. The design required high-quality, fully reliable and energy-efficient hydraulic material handling as well as an integrated software and electronics control system. The question was: how does the company tackle a development process like this without a physical prototype?

Liebherr engineering teams needed a way to investigate and evaluate various designs and related system architecture while avoiding physical mockups. They needed to make the best possible choice with regard to components and system architecture for the entire hydraulic system as well as the controls. And the impact of these choices had to be assessed for performance, reliability and durability in terms of the entire hydraulic excavator.

To make it even more challenging, a machine of this size can undergo a “backlash” effect when handling heavy materials. How can you optimize a design to avoid the additional component stress that can lead to durability and resistance issues? The engineers knew that they would have to optimize the hydraulic and mechanical parts and be able to simulate and evaluate the resulting motion and durability under working conditions to engineer the right product.

By using their new software and process, the engineers at Liebherr were able to simulate working cycles to determine the joint forces that play a role in durability, and clearly examine the best-possible design of the excavator arm under working conditions to avoid backlash and reliability issues.
The calculation and simulation department at Liebherr turned to Simcenter Amesim™ software and LMS Virtual.Lab™ Motion software from Siemens PLM Software to simulate and study the behavior of different system configurations with respect to component fatigue. The resulting parameters were shared with the design department, which checked to see if the proposed designs matched technical and functional requirements in terms of power, dynamics, efficiency, durability and maximum handling capacity. The design department also defined which system was most efficient in terms of fuel per handled-material ton.

**Saving time and money**
By using their new software and process, the engineers at Liebherr were able to simulate working cycles to determine the joint forces that play a role in durability, and clearly examine the best-possible design of the excavator arm under working conditions to avoid backlash and reliability issues. Moreover, they could analyze the dynamic behavior of the subsystem and compare different equipment versions, all without having to build an expensive prototype.

**Liebherr can now analyze the dynamic behavior of the subsystem and compare different equipment versions, all without having to build an expensive prototype.**
To achieve the correct energy balance and level of energy efficiency in the LH 120 C Litronic, the team simulated several system versions, including diverse mechanical systems of the excavator using LMS Virtual.Lab Motion and the hydraulic systems using Simcenter Amesim.

“The design table functionality is extremely helpful for changing the mechanical system very easily and quickly using LMS Virtual.Lab Motion,” says Martin Bueche, head of the calculation and simulation department at Liebherr. “Our new process works very well.”

Liebherr smoothly implemented the Simcenter solutions in the LH 120 C Litronic development process, eliminating the need for prototypes and saving a serious amount of time and money while allowing the company to maintain its strong competitiveness.

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Martin Bueche
Head of Calculation and Simulation Department
Liebherr Group