Ansys + SEW-EURODRIVE + CADFEM

"Ansys simulation software allows us to develop products faster and more effectively, to optimize product lifetimes, and to calculate precise product performance data for specific customer requirements. The tool not only supports the development process between our engineers from different disciplines, but also helps the sales department in discussions with the customer."

Dr. Jörg Hermes
Managing Director Innovation Mechanics / SEW-EURODRIVE

SEW-EURODRIVE expands market leadership and competitiveness with Ansys simulation.

Using Ansys simulation, SEW-EURODRIVE increases product performance from design to final product by an average of 30% and saves 50% on exploratory testing costs.

/ Introduction

SEW-EURODRIVE moves the world: Without the motors, gear units, gearmotors, and the associated automation technology of the traditional Southern German company, countless conveyor belts, beverage bottling plants, gravel plants, and much more would grind to a halt. As one of the world market leaders for drive technology SEW-EURODRIVE uses a broad range of tools from the Ansys simulation suite, such as Ansys Mechanical, Ansys CFD, Ansys Maxwell, Ansys Twin Builder, Ansys optiSLang, Ansys HPC, and Ansys Discovery to simulate materials, individual parts, assemblies, and complete systems, to drive technical innovations forward, to move into new markets, and to present detailed knowledge tangibly to customers. Simulation helps SEW-EURODRIVE to continually set new technological trends and better sell its products.

/ Challenge

SEW-EURODRIVE has been using Ansys simulation for almost 30 years and since then has been supported with engineering consultancy and knowledge from Ansys' long-standing elite channel partner, CADFEM. Until 7 years ago, the company essentially used finite element analysis to verify its own calculation methods. However, there were few ways to model dynamic processes and transient operations such as system behaviour or torsional vibrations – all of which have an impact on the powertrain. In addition, the global market had become more and more demanding, with new companies increasing the competitive situation by offering replicas at a lower price point. SEW-EURODRIVE needs to defend its position worldwide, to repeatedly showcase its considerable expertise in the field of design, and to expand internationally. Finally, in its core markets, the company still sees good market opportunities, particularly in the automation technology sector, but needs the right tools to help the team develop more competitive offerings.

"We were bogged down in design and therefore decided 7 years ago to carry out a complete creative destruction," explains Dr. Jörg Hermes, Managing Director Innovation Mechanics. "To do this, we set up interdisciplinary engineering teams, including tribologists, material experts, chemists, and fluid mechanics specialists among others. We allowed ourselves this luxury because we were convinced that it was the only way to effectively advance technology. We have completely repositioned ourselves with the goal of replacing 50% of our test stand trials with simulation within the next 5 years to save costs and development time, and to significantly increase the level of technology at the same time."

Dipl.-Ing. Markus Lutz, who had been working at SEW-EURODRIVE since 2007 - i.e. for 6 years at that time - and is an expert for vibrations and acoustics in the field of gear unit development, accepted the challenge and is now one of the top simulation experts at the company as head of the technology department Calculation & Simulation.

"I knew we had to be able to map dynamic processes so that we could use simulation effectively. I started with one-dimensional tools to simulate torsional vibrations and quickly realized we needed a genuine multiple-body simulation system in which we could map all degrees of freedom," says Mr. Lutz. "This finally enabled us to simulate a complete drive system. But still only rigid bodies could be mapped. This meant we needed a flexible multi-body simulation to be able to also take deformations of housings, shafts or customer applications into account."

/ Technology Used

Ansys Mechanical	Ansys optiSLang
Ansys Discovery	Ansys HPC
Ansys CFD	Ansys Twin Builder
Ansys Maxwell	

"For 90 years, SEW-EURODRIVE has been one of the world leaders in the production and development of drive technology. We need to continuously defend this position on the market. At the same time, we want to advance into new areas. We will only succeed in doing so if we are always one step ahead technologically and can test innovations quickly. For us, simulation is the cross-disciplinary platform for this."

SEW-EURODRIVE's PxG® planetary servo gear units on display.
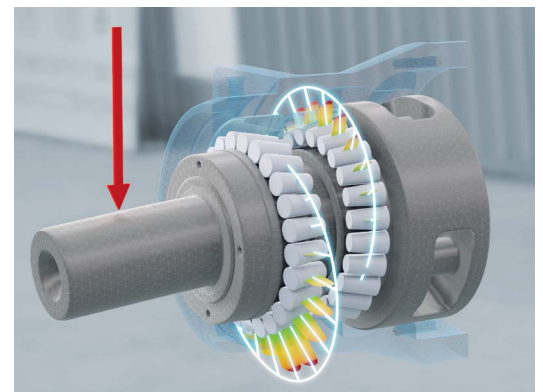
3D view of planetary gear unit with forces/Hertzian pressure on individual rolling elements of low speed shaft bearings visible.

/ Engineering Solution

SEW-EURODRIVE worked closely with CADFEM to overcome this challenge, and ultimately chose Ansys to prepare flexible bodies created in CAD for simulation and to use them in multi-body simulation.

"This was a quantum leap for the level of detail that could be mapped," continues Mr. Lutz. "We were then suddenly able to look into individual bearings, into the specific pressure distribution with all its effects such as fit, temperature, compliance of the housing, and band effects in the bearings. This enabled us to better predict the service life of individual parts, but also of systems, and to precisely determine, for example, bearing preloads for assembly or the tilting rigidity."
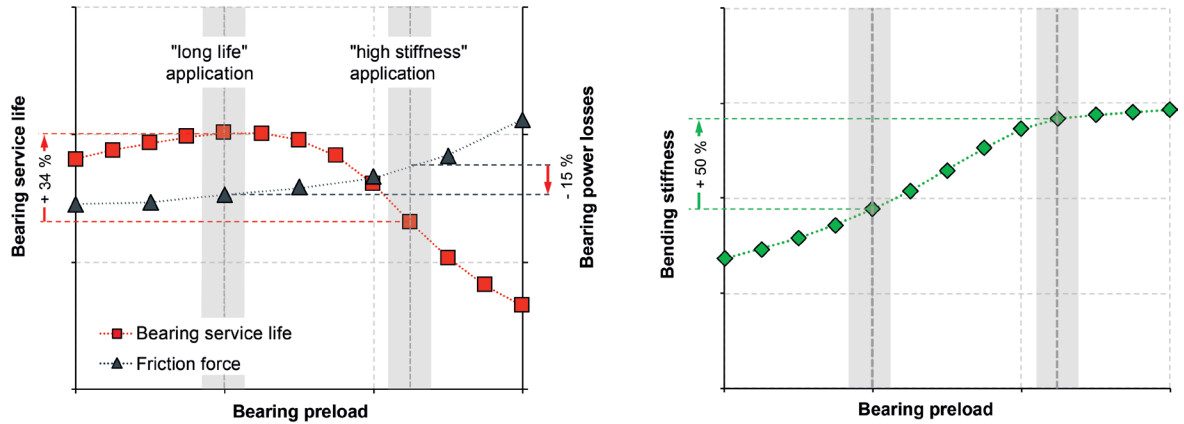
Bearing calculation for optimized bearing life or high tilting stiffness.

/ Benefits

"Overall, we were able to cut the expensive 50% of our testing, but the time we save is even more valuable," says Dr. Jörg Hermes. "It is so great that we find it almost impossible to quantify. For example, we often need more than 6 months for the planning, construction, and commissioning of a gear unit test stand with a power of 500 kilowatt. Simulation on the other hand provides us with results in two weeks. In addition to the Ansys simulation software, the long-term partnership with CADFEM and their unique expertise with Ansys and simulation was crucial for this success. We also benefit from training courses, hotline support, updates, and informal discussions at their annual Simulation Conference."

"While we still do test stand trials, simulation has enabled us to make them more targeted, smaller, and less expensive, especially for applications like validating materials or individual parts," adds Markus Lutz. "With simulation, physical validation is no longer an expensive iterative process; in 99% of cases, we only need one validation for a system."

By using Ansys simulation software, SEW-EURODRIVE has been able to increase the performance of individual parts like the planet carriers of a precision gear unit or the housing strength of an industrial stirrer by an average of 30%.

"Ansys simulation also played a major part in the development of our X.e product series and we were able to transfer those industrial gear units to the new generation," continues Mr. Lutz. "We used flexible multi-body simulation to precisely calculate the deformation of all parts and the housing and bearings of the industrial gear unit. This allowed us to develop an exact design of the micro-geometry of the gear unit which led to increased load capacity of the toothing and reduced noise. Fluidic simulation also helped us to improve the oil flow and wetting of the interior. It also led to improved thermal limit performance and a lower oil level in the gear unit."

The value of simulation is also demonstrated on other levels. The ability to quickly calculate the performance of different combinations of the large number of individual parts in a system with the help of simulation and digital twins opens up entirely new options for the sales department. Many major customers are now actively demanding simulation in their advisory discussions. Furthermore, established drive solutions are kept up-to-date thanks to simulation, with constant technology transfers from development to maintain the value of customer investments.
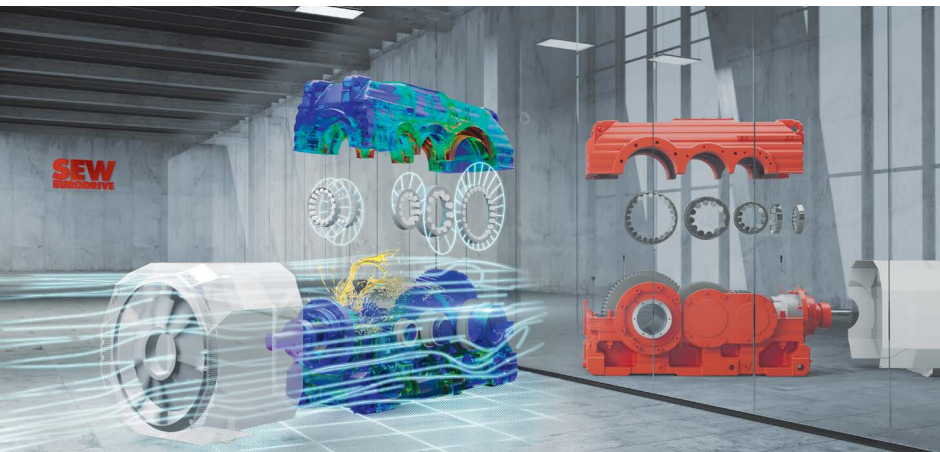
3D view of X.e-series industrial gear unit, combining all simulation disciplines (housing stiffness, bearings, toothing, oil flow, etc.)


SEW-EURODRIVE displays the inner workings of its industrial gear unit, Generation X.e, at HANNOVER MESSE 2019.

"Simulation supports us in demonstrating our detailed knowledge and even makes it tangible. At the HANNOVER MESSE 2019, we had a digital twin of one of our gear units with us for the first time. Visitors were able to see how the gear unit worked and magnify individual parts to understand certain processes, like how oil lubrication works," reports Dr. Hermes. "We also began publishing the "up to date" information series in 2020, regularly providing information on how our proven gearmotors are also optimized and kept up to date. In the future, simulation will be used in development, consulting, production, as well as during operations at the customer."

Since complete systems, including individual parts and their strength and vibrations, can now be mapped within the simulation software, the next logical step for Markus Lutz is acoustics: "We want to make the gear unit audible in the simulation. And we want to do so quantitatively and qualitatively. Like sound designers for car doors, we want to ensure that our gear units are not too loud and have pleasant acoustics."

"Thanks to simulation, we have never lost our role as one of the world market leaders in drive technology over the past 7 years, and we have even been able to significantly increase our market share in other areas," summarizes Dr. Hermes.
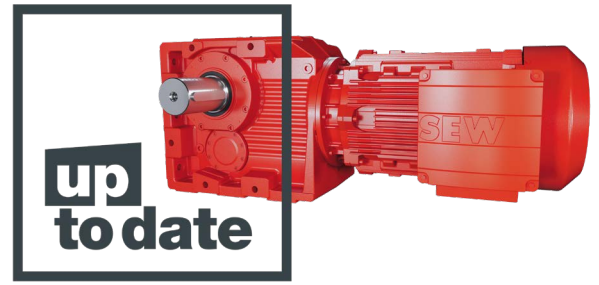
The "up to date" program from SEW-EURODRIVE

Dr. Jörg Hermes
Managing Director Innovation
Mechanics / SEW-EURODRIVE

Markus Lutz
Head of the technology
department Calculation &
Simulation / SEW-EURODRIVE

/ Company Description

SEW-EURODRIVE was founded in 1931 and has been setting standards in drive technology for 90 years. Today, the company stands for product orientation with a modular system as the basis for success, for process orientation with the precise coordination of consulting, product, delivery time, training, and service support, and also for future orientation with distinctive knowledge that is inherent in the various areas and in every product. For example, the motor, gear unit, and electronic components drive conveyor belts, mobile transport systems, cranes, bottling plants, and countless other applications and production lines, for example – whether in automotive plants, in beverage and food production or, for example, in the cement industry. The family-owned company employs more than 18,000 people worldwide and has an annual turnover of over 3.3 billion euros. The headquarters are in Bruchsal near Karlsruhe, Germany.

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