ALTAIR'S DIGITAL TWIN CAPABILITIES OPEN THE DOOR TO INNOVATION

Developing doors, windows, and safety systems for smart buildings, GEZE provides products, system solutions, and services to a global market. To fully leverage the benefits of simulation, the company implemented Altair solutions to enhance collaboration and innovation right from the start.

Founded in 1863, GEZE is a family-owned business employing over 3,000 people across 37 locations worldwide, including production facilities in Germany, China, Serbia, and Turkey. GEZE specializes in the development and manufacturing of innovative door systems, window technology, and security solutions, managing the entire process from initial concept through to planning, production, installation, and after sales services. Additionally, the company offers bespoke system solutions and personalized service and maintenance.

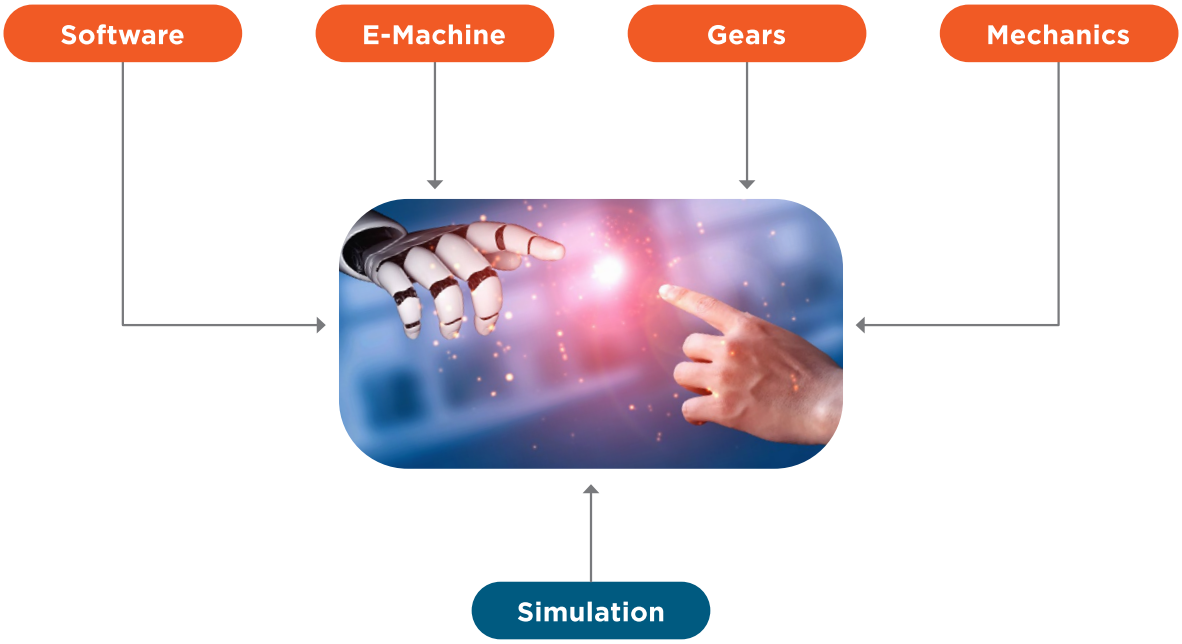
Complex Systems Developed by Distributed Teams

Developing a new product is challenging for any manufacturer, especially when the product is as complex as GEZE's mechatronic systems. Historically, GEZE's product development process involved highly specialized, distributed teams working within their respective domains, only coming together at the end to build a functional prototype. Even as recently as 2023, designers usually created a design, built a prototype based on the various departments' results, and only then tested the prototype. Essentially, the company used simulation only at the end of the development cycle for evaluation and troubleshooting. Often, the first prototype didn't function as intended, necessitating numerous modifications, lengthy iterations, and, the production of additional costly prototypes.

Designing complex mechatronic systems such as GEZE's electromechanical swing door drives is a challenging development task.

Need for Change at GEZE

GEZE recognized the need to reduce their reliance on prototypes to streamline their development process, ultimately aiming to cut development time and costs. To achieve this, they sought to establish a professional simulation team and implement an effective simulation process, including the standardization of simulation procedures and reports, while covering the company's wide range of simulation domains. Overcoming GEZE's distributed development work was a major challenge. "Our inability to build a first-time right prototype was due to the silo-like development process that led to speaking different development languages while working on the same product," said Marc Fiedler, team leader, simulation, GEZE.



GEZE needed a new simulation environment that covered a wide range of simulation domains, a unified, collaborative platform that all teams could use.

The second challenge the simulation department faced was choosing the right software. Before partnering with Altair, the team used a simulation tool that underdelivered on its promise of high functionality and efficiency, causing many issues due to incomprehensible simulation results. Additionally, the software was quite expensive, as additional functions had to be purchased separately. In short, GEZE's simulation department couldn't perform useful simulations due to inadequate software that hindered innovative product development.

To address these challenges, GEZE needed a new simulation environment that covered a wide range of static and dynamic analysis in different simulation domains, including mechanical, electric, electromagnetic, control, thermal flow and hydraulic systems. They required a unified, collaborative platform that all teams could use. To establish a highly productive and efficient simulation team, the department needed a tool capable of performing and integrating various types of simulations. To achieve their ambitions, they turned to Altair.

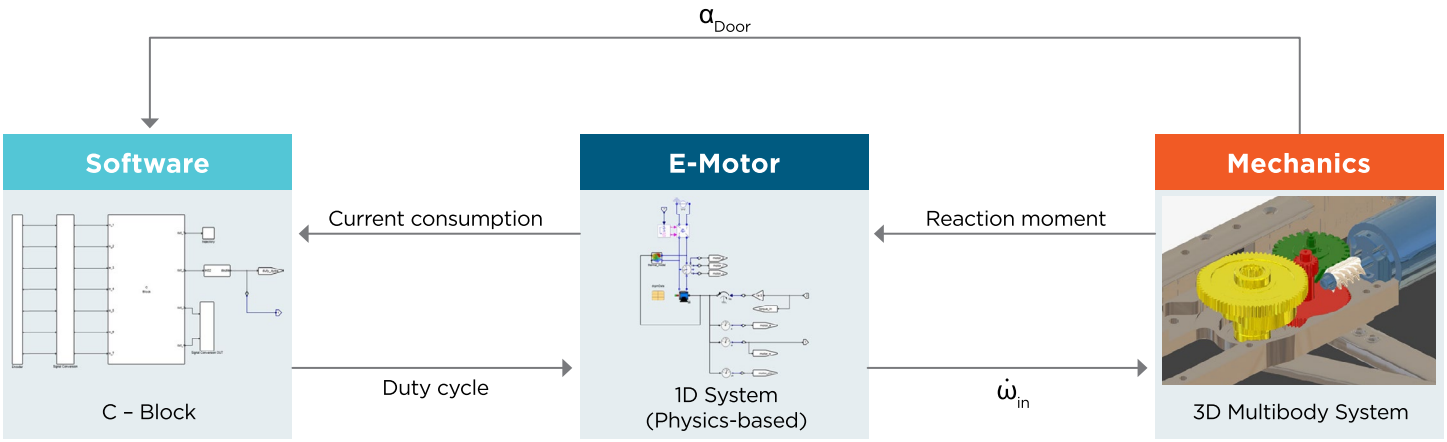
Putting Altair Solutions to the Test

The most compelling reason for GEZE to choose Altair solutions was Altair's comprehensive, industry-leading software portfolio. It includes all the tools GEZE needs at a fixed price, thanks to the flexible, cost-effective, units-based Altair Units licensing system. Altair Units allowed GEZE to use any software in Altair's extensive range of tools while enabling connection and interaction between different solvers. GEZE was particularly impressed by how easy it was to combine tools – for instance, integrating a hydraulic system with a mechanical system – within a single simulation model.

However, GEZE's plans were also more ambitious, extending beyond individual simulation solutions. They envisioned a digital twin project that would harmonize the results of their highly distributed teams within a single prototype. GEZE's vision for the team was a shared platform that facilitated joint development right from the beginning of new projects. The goal was to enable the departments to test and validate all components long before the first prototypes were built. **Altair® Twin Activate®** provided the exact solution to realize this vision.

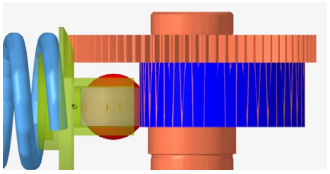
Digital Twins for Virtual, Distributed Development

Enabling cross-domain collaboration within development isn't always easy, since departments often have their own understanding of systems, requirements, and terminology. To address this, GEZE collaborated with Altair to build digital twins of door systems using **Twin Activate** in combination with **Altair® HyperMesh®**, **Altair® OptiStruct®**, **Altair® HyperView®**, **Altair® Inspire™** and **Altair® MotionView®** for hydraulic simulation and control system design.

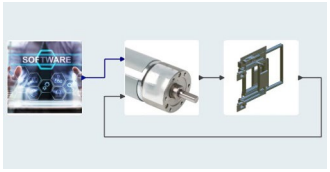


Interaction of control software, electric drive, and mechanics in the system model in Twin Activate

These digital twins, which encompassed mechanics, hydraulics, and control systems, served as a cross-domain communication platform during the development process, providing a common language for all experts and departments. With this unified digital twin environment, different domains and departments can work together seamlessly, creating a common understanding of the interaction of each team's respective results. This fosters a complete virtual product development process with significant benefits: the minimization of physical prototypes and the reduction of development costs and time.



Detailed view of the mechanic model in the multi body simulation



System view of the automatic door drive in Twin Activate

Comprehensive Project Implemented in No Time

Knowing that implementing digital twins can be complex, GEZE estimated the total implementation would take at least 500 hours to deliver useful results. However, thanks to Altair's solutions and expertise, GEZE created a working digital twin in just 160 hours – a total working time of less than three months. "We planned 500 hours for the whole project – and now, after only 160 hours, we have already achieved our goal," Fiedler said. "The 200 hours that we expected for the software integration were cut down to just one day. The Altair support team was outstanding during the project, always providing competent answers to all our questions quickly."

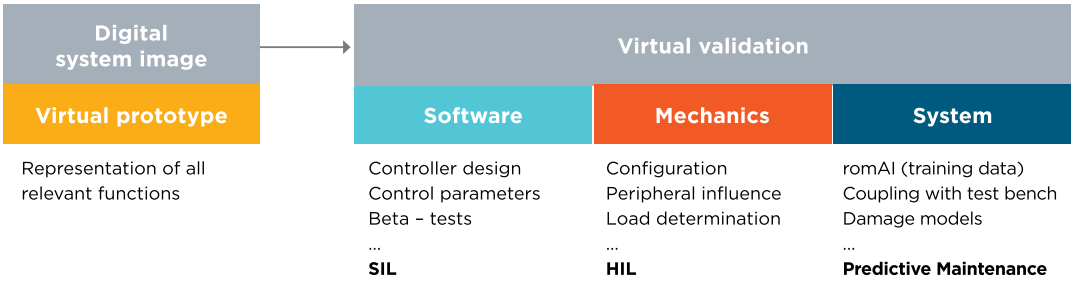
The Unparalleled Power of Altair Units

To GEZE, the Altair Units system was astounding, giving their team access to Altair's universe of solutions under a single, flexible, and scalable license. "The Altair software suite, with its extremely large selection of simulation tools, is and remains the perfect choice for us at GEZE," Fiedler said. "While we pay for downtime with other software tools, with Altair, we always have 100% license utilization. Nothing lies idle, and nothing goes unused. Every single Altair unit can be used by anyone at GEZE, anytime. For each Altair unit purchased, there is a multitude of license features available. This saves a lot of money compared to traditional license models."

Above and Beyond Pure Simulation Results

While GEZE was confident that the new approach would streamline the development process, the company was delighted by the overwhelmingly positive reaction to the new digital twin concept. Everyone, from the experts to the managing director was enthusiastic about the new approach.

In addition to the Altair solutions' ease of use, Fiedler attributes this reception to Altair's exemplary communication during implementation. GEZE now understands firsthand the benefit of a shared, unified simulation environment. "Since the eighties, we have been working in silos – and we all knew it. Now, with Twin Activate, we can get our domain experts out of their silos, as we finally have a simulation environment that brings the different departments together," Fiedler said. "Thanks to the common language and environment Altair's tools provide, we have finally reached the point where we can work together to find solutions right from the start of the development process. This frees extra time to spend on innovative development. All good ideas get a chance because we now have the time to try out good ideas without having to reserve time on the test bench."

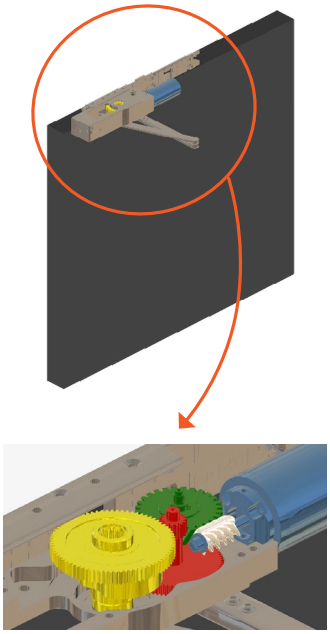


Schematic representation of the virtual prototype as a digital system representation and the interaction of the various development disciplines.

Benefits Galore

GEZE has derived numerous benefits from Altair's solutions, including:

- Harmonization of development processes across individual divisions
- Reduction of development iterations
- Strategic supplier management through targeted component selection based on precise requirements
- 100% license utilization with no downtime costs
- Increased innovation and time for exploration
- Improved communication through a common, shared platform



Detailed view of the door drive in the MBD model

Roadmap for Digital Twin: Virtual Development Right from the Start

While GEZE is very happy with the results of the new concept, it's already looking ahead and setting new goals for its digital twin journey, such as integrating simulation as early as possible. "Frontloading is key to our virtual approach; simulation is most powerful when it is integrated into the simulation process or the development process from the outset," Fiedler said. "The earlier we are using simulation in the development process, the greater the benefits."

Additionally, the company envisions connecting the digital twin model with testing rigs to perform live durability analysis, allowing for precise maintenance intervals. Ultimately, the digital twin models could be connected directly to customers' systems to provide real-time physical information about the systems' states. "Our long-term goal is for each product to become 'self-aware' through its digital twin and to be able to perform a comparison with the environmental influences, in real time," Fiedler said. "Thanks to the digital twin, the system could then automatically inform our service team to carry out the required maintenance work long before the customer even notices there might be a problem. This next step, moving from a digital twin for design towards a digital twin for operations would be another milestone to achieve GEZE's digital twin journey."

This approach also paves the way for future business models, where the company can make targeted statements on the service life and maintenance requirements of individual components, including detailed failure prediction, even before the first product has been commissioned.