Customer Story

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Speeding the Industrial Design Process with Modern Calculation Management



HITACHI

Key Highlights

Industry Heavy Machinery

Challenge

Accelerate the design process and manage calculations used during development

Altair Solution

Maple by Maplesoft via the Altair Partner Alliance

Benefits

- Accurate solutions obtained more guickly
- Streamlined and efficient calculation management
- Reduced errors and faster time to market



Overview

Hitachi Construction Machinery Co., Ltd. (HTM), together with its subsidiaries, engages in the manufacture, sale, and service of construction machinery, transportation machinery, and other machines and devices. The company operates in three segments: Construction Machinery, Industrial Vehicle, and Semiconductor Production Equipment. The Construction Machinery segment provides excavators, mini excavators, wheel loaders, dump trucks, cranes, and foundation machines. The Industrial Vehicle segment offers forklift trucks, transfer cranes, and container carriers. The Semiconductor Production Equipment segment provides ultrasonic inspection equipment and atomic force microscope equipment. The company

also offers various parts and services for the equipment; and provides used machines and attachments. It serves mining and quarry, general construction, forestry, demolition, and water and scrap recycling industries. The company operates primarily in Japan, China, Indonesia, Singapore, Thailand, Malaysia, the Netherlands, France, the United States, Canada, New Zealand, Australia, and South Africa. Hitachi Construction Machinery Co., Ltd. was founded in 1970 and is headquartered in Tokyo, Japan.

Challenge

In the current climate of industrial trucking products, truck manufacturing companies are striving to improve their products more efficiently than ever before. These improvements can come in many forms, but in an industry of expensive prototypes and

Hitachi Customer Story



"Using Maple can make calculations more efficient than using spreadsheets."

Dr. Shen, Senior Manager of the Technical Analysis Group at HTM

stiff competition, it is critical to find innovations that fit within tight margins, fast development cycles, and that deliver guaranteed reliability in the field. Regardless of the particular innovation, some amount of careful calculations is required to ensure that the concept is feasible.

In the pursuit of developing high-performance hauling trucks, HTM needed new design techniques that would help them manage all calculations involved during development. Their current methods for deriving new designs often rely on simulation software and a collection of disparate mathematics tools. Some calculation tools were developed with spreadsheets, which have disadvantages including hard-to-diagnose errors and a lack of unified, transparent calculation auditing. While sometimes sufficient, the legacy approaches they have been using to manage intellectual company property can end up introducing redundancies and slowdowns in a variety of ways during the design process.

Solution

The engineering department at HTM is taking steps to improve their rigid-frame hauling truck design by improving their analysis tools. The team decided to gradually implement Maple in several key areas to help speed development and reduce the risk of errors from manually handling calculations across many tools.

As an Altair customer, Hitachi has access to Maple through the Altair Partner Alliance. With an easy process for download and use, HTM engineers were able to access Maple at their own convenience and seamlessly incorporate the software into their toolchain.

During typical analysis tasks at HTM, engineers use specific mathematics to work through design concepts, model their kinematic behavior, and analyze their structural integrity over time. In the truck's initial design stage, HTM has historically used developed spreadsheet programs, but moved to Maple to reduce the chance of errors and improve calculation efficiency. In addition, Maple has been adopted to optimize design parameters throughout the truck design process. "Using Maple can make calculations more efficient than using spreadsheets," noted Dr. Shen, a senior manager of the technical analysis group,





Performing FEA work is often very time- and resource-intensive. By using Maple, Dr. Shen is able to quickly approximate material stresses and use FEA to perform only the final leg of analysis



Transitioning from traditional tools like Excel to Maple helped Hitachi streamline their calculation management process and reduce the risk of errors.

when explaining his past experience using spreadsheet tools for analysis work. Using Maple, HTM engineers can set up their analysis with an intuitive math input and use built-in functions to automatically solve and simplify work, reducing many of the possible errors they had associated with traditional, manual effort.

The rigid frames developed at HTM must support massive payloads ranging up to almost 300 tonnes. To make sure these frames are suitable for the job, HTM uses finite element analysis (FEA) to investigate the life of welded joints, helping to determine the required size of each weld. While FEA is a powerful tool, it can be very resourceintensive, slowing down critical aspects of design analysis. Using Maple, HTM engineers perform initial stress estimations that give them a much better sense of their design before spending large amounts of time doing FEA iterations. With a better starting point, the FEA work is already honed in on rough approximations, so it can arrive at accurate solutions much quicker.

In addition to improving the analysis capabilities of HTM, engineers are also beginning to integrate Maple into the reports they must regularly create for records. In the past, these reports would be an entirely different task and any necessary mathematics would be inserted as screenshots, creating a break between the actual analysis and the report itself. With Maple, the documentation interface offers all of the features necessary for professional reports, and the mathematics involved are live, allowing updates to be reflected immediately across the entire document. Although still in the beginning phases, HTM engineers can now use Maple as a means to easily create reports from their pre-existing analysis work. As time goes on, this will allow engineers to create a live connection between their analysis work and their reporting, ensuring that future changes are reflected across all the relevant documents at hand.

Maple is a key piece of calculation management software to streamline the way that design improvements are created and used. By using Maple, HTM is now able to perform fully traceable design analyses, make use of powerful optimization techniques, and seamlessly integrate calculations into auditable reports.

Conclusions and Outlook

By adopting Maple as a tool for calculation management, HTM is joining the growing number of organizations that are treating their engineering calculations as an essential company asset. Responding to an increasingly competitive market, HTM is finding success by reducing the many sources of inefficiencies caused by legacy calculation tools. The success that HTM is finding with Maple is the result of treating calculations as a structured asset, ensuring they are created, reused, and distributed with care and attention. The migration from old techniques still continues, but HTM engineers are already seeing the benefits of adopting Maple for a variety of tasks that were once performed in older, generalpurpose tools. With proper calculation management tools in place, HTM is creating powerful, efficient tools that reduce development risk and get their products to market faster. They've used Maple's powerful optimization features to push more performance out of their designs, and are creating a stable foundation of design calculations that are fully auditable and easy to understand - an invaluable resource for both current and future employees.

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About Altair

Altair (Nasdaq:ALTR) is focused on the development and broad application of simulation technology to synthesize and optimize designs, processes and decisions for improved business performance. With more than 2,000 employees, Altair is headquartered in Troy, Michigan, USA and operates 69 offices throughout 24 countries. Altair serves more than 5,000 customers across broad industry segments.

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About Altair Partner Alliance

One Platform. One License. One Source. All Access.

The Altair Partner Alliance (APA) provides access to a broad spectrum of complementary software products using customers' existing HyperWorks Units which can be used to download and use partner product applications on-demand. This constantly growing portfolio extends their simulation and design capabilities to help create better products faster. Altair plans to continue to add valuable third-party software solutions to the HyperWorks platform to empower innovation with comprehensive enterprise analytic tools. We believe the Altair Partner Alliance is unique, because it allows customers access to non-Altair software along with their existing HyperWorks Units, provides an opportunity to reduce infrastructure and administrative costs, and gives them the ability to quickly evaluate and deploy software on-demand.

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