

## MAPLE TOP USE CASES

Altair Partner Alliance

# Speeding the Industrial Design Process with Modern Calculation Management

## Challenge

- In the pursuit of developing high-performance hauling trucks, Hitachi Construction Truck Manufacturing Ltd (HTM) needed new design techniques that would help them manage all the calculations involved during development.

Their current methods for deriving new designs would often rely on simulation software and a collection of disparate mathematics tools. Some calculation tools were developed with spreadsheets, which have the disadvantages of hard-to-diagnose errors, and a lack of unified, transparent calculation auditing.

## Solution

- HTM has selected Maple as 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.

## Results

- HTM has already begun to remove a variety of slowdowns and design errors that stem from using their old calculation tools.

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.



# Maple Helps Engineers Design Propulsion Systems for Some of the World's Biggest Ships

## Challenge

- The engineers at MAN Diesel & Turbo Propulsion Competence Center in Denmark needed to replace their existing mathematics software used in the design of propulsion systems for the global maritime industry.

The existing mathematics software used in the design calculations required the engineers to transpose all relevant equations from their original format into its specialized software language, which was a time-consuming process.

## Solution

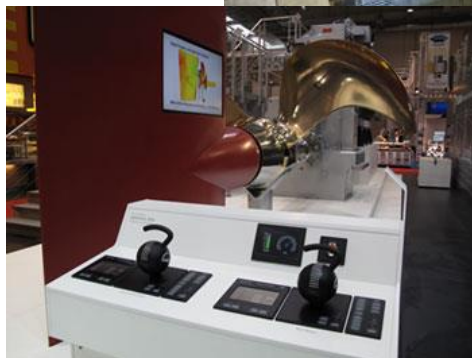
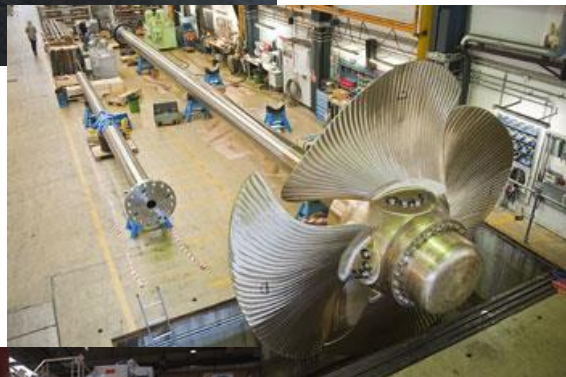
- The engineers at MAN Diesel & Turbo Propulsion Competence Center selected Maple for its speed and accuracy.

Maple allows engineers to enter the design equations in their original form directly into the system, reducing the need to check and debug the code.

## Results

- Only 6 months after replacing the mathematics software with Maple, its power, speed and efficiency have convinced the engineers to explore using Maple in other areas.

Engineers are looking at the feasibility of building standard models to simplify and automate the process further by automating the links between the initial calculations and the detailed part models in the 3D CAD system.



# 25 Years of Calculation Management Done Right: David Shelby of Eastman Chemical Company

## Challenge

- As a Research Fellow at Eastman Chemical Company, David Shelby needed a way to easily develop solutions for a wide range of technical challenges.

Many of the current software tools at his disposal were developed for specific applications, requiring him to develop expertise with many different tools, which could pose slowdowns or make it harder to transfer work between projects.

## Solution

- David chose Maple as his multipurpose tool for calculation management at Eastman.

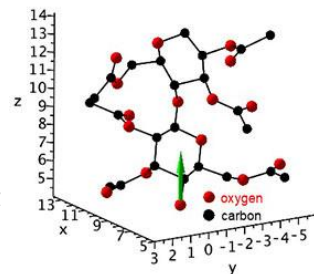
He now uses Maple to manage his projects from start to finish, including data collection, scratch calculations, solution development, optimization, and technical reporting.

## Results

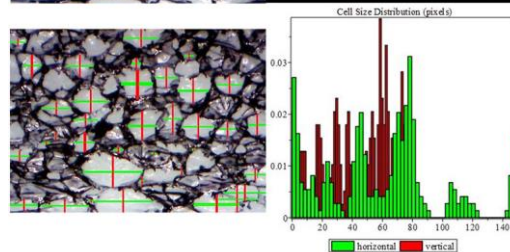
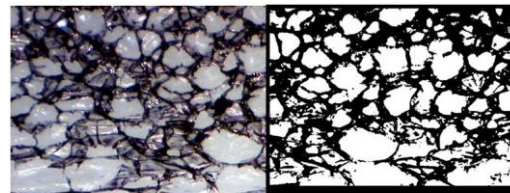
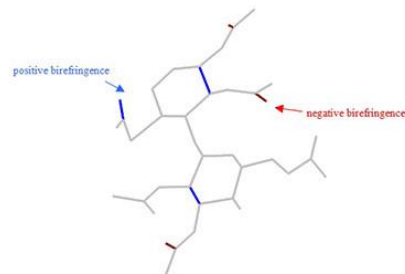
- By using Maple as his primary calculation tool, David can now develop solutions more effectively, and reference projects easily to ensure he leverages past work as often as possible.

He has used Maple to develop and optimize solutions for projects across the entire company, helping turn development hurdles into design features.

Cellulose Ester Monomer Atomic Positioning via X-Ray (in Angstroms)



Bonds Having Strongest Influence on Orientation Birefringence



# Optimize Mining Equipment & Process

## Challenge

- Distance from mining location to the processing plant continues to grow
- Managing fuel and maintenance costs is becoming increasingly difficult

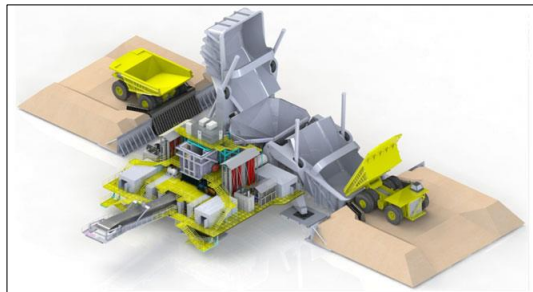
## Solution

- Maple and MapleSim were used to develop models and analysis tools to help FLSmidth optimize the design of their Dual Truck Mobile Sizer (DTMS) - a machine that can be relocated throughout the mine.

## Results

- More economic and efficient material processing delivered by twin skip system
- Reduction in vehicle operating costs

For a detailed case study, please [click here](#).



*“The level of design detail and the amount of insight we gained have enabled us to revolutionize onsite crushing through the development of the DTMS.”*

- **Willem Fourie**, Global Product Manager, FLSmidth

**FLSMIDTH**

# Develop Motor for Full Electric Vehicle

## Challenge

- Most electric vehicle motor design processes cannot effectively juggle driving pleasure, mass production requirements, deadlines, budget, and quality.

## Solution

- Maple used to create first-order approximations of rotor and further develop math models based on physical equations.

## Results

- Reduced mass of the rotor - car can travel further on the same battery charge
- Significant reduction in the need for experimental learning

For a detailed case study, please [click here](#).



*“[Maple’s] breadth enabled us to create models that are perfectly suited to our needs and achieve outstanding results early on in the design process.”*

**- Patrick Orval**, Computational Modeling and Simulation Methods Engineer, Renault



# Refine Complex Target Tracking

## Challenge

- Controller code for radar tracking gimbal must track a target as it moves, in real time
- Traditional numeric computation techniques are too slow

## Solution

- An inverse kinematic problem was defined
- MapleSim and Maple used to model the problem, and find an analytical, symbolic solution.

## Results

- High quality results were obtained quickly
- Generated code runs in real time

For a detailed case study, please [click here](#).



*“The symbolic approach to our problem, using MapleSim and Maple, allow us to deliver a more accurate, better performing solution to our customers than when using other methods.”*

- **Neal Romine**, Blue Joule Corporation

# Build Assistive Robotic Arm

## Challenge

- Need to solve advanced algorithms involving large matrix equations to calculate kinematics and applied forces through the arm

## Solution

- Maple was used to create a system of trigonometric equations that represented the problem
- Maple's symbolic computation engine analyzed and simplified the equations, to generate the output function that calculates the hand's position

## Results

- Simplified set of equations executes faster, resulting in faster reaction time and more refined control
- Reduced development time

For a detailed case study, please [click here](#).



*"We needed software that is known for its robustness – one that is able to manage large equations and matrix computations, and return symbolic solutions."*

**- Alexandre Lecours**, Project Manager, Robotic Algorithms and Control Team, Kinova Robotics