Mazda

'Irreplaceable' Romax enables innovative transmissions with improved fuel economy and robustness

Client

Global auto manufacturer with production and R&D sites including Japan, China, USA, Germany, Mexico, Russia, Malaysia, Zimbabwe.

Challenge

Achieving company and product goals faster in design and development: deliver innovation and balance environmental needs with fuel economy, robustness, safety and performance.

Solution

Romax software to optimise design and development in multiple complex overlapping projects.

Benefits

Fast and accurate analysis under multiple conditions to speed up development and deliver innovation, particularly in transmission design; helping to optimise processes and move towards Right First Time™; contributing a substantial improvement in fuel economy.

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Mr. Miyamoto
Engine Performance Development Department
Mazda

Headquartered in Hiroshima, Japan, and with more than 20,000 employees, Mazda Motor Corporation is one of the world's leading automakers, with product lines that include passenger cars, SUVs and vans, gasoline and diesel engines, and automatic and manual transmissions. The company is dedicated to delivering innovation, with recent initiatives including continuing reductions in carbon emissions and improvements in fuel economy. Indeed, with Mazda's "Sustainable Zoom-Zoom" environmental policy complemented by the belief that its cars should be attractive to look at and fun to drive, Romax software plays a key role in meeting increased consumer and market expectations.

"We're expected to achieve the optimal balance of environmental performance, safety performance, and pleasure in driving," says Mr. Takashi Miyamoto of Mazda's Engine Performance Development Department. "That's challenging itself - and even more so because Mazda sets its goals at higher levels. Innovation in products is extremely important to us, and Romax helps Mazda to achieve that: to provide more accurate and effective optimised designs faster, and therefore at lower cost. Thanks to Romax we can make calculations under various conditions, so we know our products will have robust performance, and using Romax software in our SKYACTIV transmission project means we have seen substantial improvement in fuel economy. Romax software has been an irreplaceable tool in the design process, enabling us to develop the new range of transmissions quickly, accurately and with confidence."

Why Romax?

With Mazda using Romax software since 2005, Mr. Miyamoto says the key challenge in design and development was the need to develop a range of innovative new products in a short time frame, covering both front-wheel drive and all-wheel drive multiple engines and transmissions. "We hadn't previously experienced such a large number of complex over-lapping projects, with many having to be advanced at the same time. For a mid-sized company with limited resources, it was clearly an issue, but one that computer-aided engineering (CAE) technologies could help us address. We wanted to address environmental concerns and radically change our products to meet higher expectations." With internal combustion engines continuing as the mainstream - albeit with an expansion in electric devices - Mazda's building-block strategy for product innovation required improving base technologies first (for example, improving engine thermal efficiency and reducing the weight of the vehicle body), then gradually introducing electric devices such as idling stop systems, regenerative braking and motor drive technology. Mazda's collective term for these next-generation base technologies is SKYACTIV Technology. "We initially chose Romax software to design the basic structure of a new transmission more efficiently," Mr. Miyamoto says. "This has actually evolved into today's SKYACTIV transmission. We chose Romax because it was the only software that satisfied our needs."

'The sky's the limit' - Romax in action

With Mazda designers and developers exploring areas including noise and vibration, strength, and fatigue, Romax software played an important role in creating a more efficient development process, with MBD (model-based development) focusing the application of CAE technologies in the most effective ways, from initial design onwards. The new development process was based on a common engineering architecture concept for each project, considering various scopes and conditions. In this environment, Mr. Miyamoto says, Romax software brought greater speed, improved accuracy and increased robustness. "In terms of speed, unlike huge finite element method (FEM) models, Romax provides a short computation time plus a user-friendly interface. With accuracy and predictability, many joint models such as splines, gears and bearings are already built-in with Romax software. And with robustness, rather than using experimental values, we can perform analysis under a number and range of boundary conditions such as torque, gear ratio, and so on.

"We determined many optimal shapes and specifications, with almost all decisions made with reference to CAE results, devising how Romax would fit into development as part of an optimised process," says Mr. Miyamoto. "For example, we applied Romax to structural analysis related to transmissions: combining Romax with existing structural analysis technologies to improve efficiency and prediction accuracy. Specifically, we calculated joints and gear characteristics using Romax software, and used these values in our analysis as boundary conditions. To look at whine noise and vibration generated by a transmission, we have to predict the exciting force and transmission characteristics as accurately as possible, so we used Romax software to calculate gear alignment errors and bearing characteristics. Benchmark analyses are performed in order to reduce whine noise – one of the most difficult NVH phenomena to counter, with models of transmissions built and their mechanisms of whine noise analysed in detail using Romax. We also gain knowledge on how to control dynamic stiffness in manual transmissions, with those insights used to design the initial gear structure. Romax makes the optimisation process speedy and efficient."

Towards Right First Time™ design

With SKYACTIV Technology already featuring in a range of new vehicles, Mr. Miyamoto says, "Romax helped our development and provided substantial time savings and cost reduction because we could reduce a great deal of trial manufacturing and experiments." He believes that Romax software is helping Mazda move closer to Right First Time™ design. "The concept of Right First Time™ is similar to our own approach. It is ideal that we can design specifications in any projects and make minimum trial manufactures and only need to confirm its performance. We are aiming at this smart process. We always try to design the optimal specifications before the first drawings, by applying CAE technologies. Romax clearly helps us to move closer to this ideal." Indeed, he says Romax has contributed to specific development gains, including the lightweight SKYACTIV transmission that delivered substantial improvement in fuel economy, "with direct driving that feels like a manual transmission. It provides a light and crisp shift feel, like a sports car."

"Romax software has brought a great contribution to our business because it's fast, accurate and robust, performing optimisation quickly and efficiently. We will continue using Romax software in other development initiatives and to design further detailed specifications."

Mr. Miyamoto
Engine Performance Development Department
Mazda

To find out more

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