

Hyundai WIA

Romax Concept and RomaxDESIGNER drive more focused, streamlined and low-cost development of innovative products



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Senior Research Engineer, Hyundai WIA

Part of Hyundai Motor Group, Hyundai WIA produces a range of high-tech products including key automotive components, machine tools, industrial machinery and defence products. The company has evolved from one of Korea’s leading companies into a world-class corporation, using innovation to help ‘build a better future for all’, with 5 R&D centres including Uiwang (Machine Tools), Hwasung (Powertrain and Driveline) and Changwon (Industrial Machine) in Korea alongside Detroit in the USA and Frankfurt in Germany. Hyundai WIA’s Drivetrain Engineering team, Powertrain and Drivetrain Testing team, Control Logic Development team, Engine Engineering and High-Tech Engine Component Engineering team use RomaxDESIGNER and Concept software to streamline and enhance the design and development process.

“We’re a leading manufacturer specialising in powertrain and driveline,” says Kisung Lee, Senior Research Engineer. Products include engines, four-wheel drive (4WD) parts, manual gearboxes, six-speed dual clutch transmissions (DCT), half-shafts, chassis modules, reduction gears for electric and fuel cell vehicles and

Client

Leading Korea-based automotive parts and machine tools business; total annual revenues of more than US \$8 billion.

Challenge

More quickly and accurately design and develop multiple products in broadly similar areas (e.g. drivetrain) but with highly different requirements/end users, meaning varying technical targets and development goals.

Solution

Romax Concept software for initial design stage investigations, and RomaxDESIGNER for further, detailed simulation of the gearbox model.

Benefits

Optimise designs earlier to move closer to Right First Time; drive process improvements with Romax underpinning the 'Agile Develop' approach; make significant time and cost savings while addressing global standards including ISO and AGMA.

electric couplings. Since implementing Concept, Lee says, Hyundai WIA has used the software in a feasibility study for diesel manual transmissions, system efficiency analysis including motor specification in the development of an electric vehicle (EV) speed reducer, a 4WD project, concept design assessment for new industrial machinery, and to make process improvements in its overall design and development capability. "Concept software is the starting point of the whole product developing," Lee continues. "We chose Romax software because it covers the whole geartrain development process – and it's also used by Hyundai Motor Group. The results Romax software provides are very helpful, and the main benefit is time saving, enabling us to calculate and analyse areas ranging from gear life and fatigue to efficiency without using other software packages."

Accelerating delivery of higher quality products

Lee says the main challenge in design and development is having the flexibility to address the demands of multiple products with different uses, meaning varying technical targets and development goals: "We needed to create a new gear design and development process to meet additional customer demand for manual transmission and 4WD parts, covering changes to gear ratio, diesel and gasoline engines, torque, and centre distance."

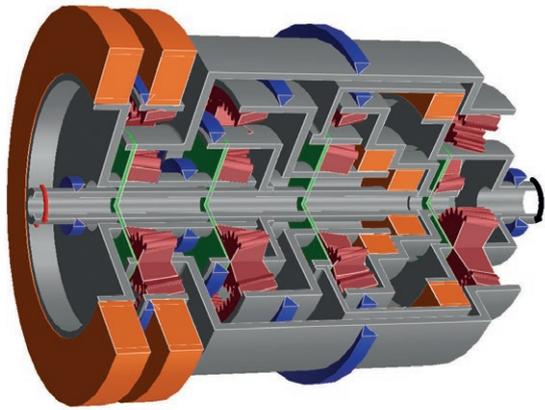
This streamlined process – known as 'Agile Develop' – accelerated delivery by taking customer requests into design assessment and detailed design far more quickly than before. "We developed this process using Concept and RomaxDESIGNER software," Lee says. "We've been using Concept since 2013, and RomaxDESIGNER since 2009." Concept is mainly used by the Driveline Engineering team, while RomaxDESIGNER is used by the Powertrain/Industrial Machine Design team and Analysis team. "While other software can be helpful to design just one pair of gears, you can't look at the whole system. Romax enables

the analysis and calculation of the entire system – we can carry out whole-system analysis."

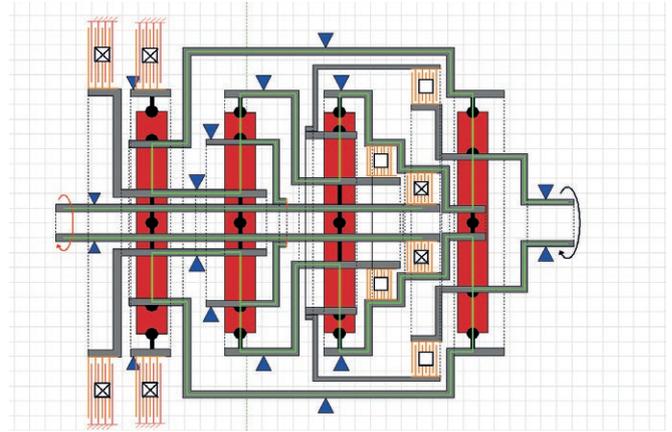
Models can be begun in Concept, or imported in from the Romax model library, in order to explore geometry, speed, rating and load dependencies, and carry out dynamic analysis. Then, results are exported for further finite element, structural, micro geometry, NVH and durability analyses in RomaxDESIGNER, including correlation with test results. If required, fully interoperable capabilities enable the RomaxDESIGNER model to be exported back into Concept. "We can carry out a simultaneous design assessment between concept design and detailed design, with the opportunity to review the various specifications involved," Lee explains. "The process is simple and easy to show. Without Concept, this would be impossible. Our design teams now follow this process, which is extremely helpful in choosing the part specification and feeding into further analysis."

Powering development

Concept enables more informed and focused decision making earlier in the process; this has led to more agile development of manual transmissions, speed reducers and 4WD parts, as well as providing a new layout design for machine tools including a large lathe. Lee says, "Romax enables us to move more quickly and easily from basic geometry, gear strength and calculating the bearing load and indicating load direction in the first stage, through to detailed gear design review, vehicle level system and energy efficiency, and material cost estimation in the second stage." During the process, Hyundai WIA uses the full range of Concept's report functionality, including: design summaries and component position reports, material costing, ratio selection, tooth passing frequency, gear sizing, clutch capacity, bearing load and life ratings, axial force reports, gear ratings, efficiency and fuel consumption.



Example Concept model



Right First Time

Lee says Concept enables a more streamlined and compact development loop: "It helps decrease development time and helps in minimising design failure. Through a smaller development cycle we can make products more robust at an earlier stage - using Romax enables us to overcome limitations we might face, as well as meeting Right First Time design requirements." The benefits of an enhanced design capability early in the process are clear: "It relates to the cost effect," Lee adds. "With Design For Six Sigma (DFSS) and the Six Sigma process improvement approach, most companies now appreciate the benefits of early-stage design fixes. Our internal customers – including Control, Shift Quality and Vehicle Test teams – want to receive complete development parts, not a developing one. So Romax software is extremely helpful to design Right First Time, including both part optimisation and process optimisation. Time and cost savings with great results are the main reasons Hyundai WIA uses Romax software."

Lee says the company will continue using Romax to create new products, including a new-type speed reducer for next generation Fuel Cell Electric Vehicles (FCEVs), multi-speed 4WD parts and industrial machine gearboxes – with, he says, the entire process from concept design and design assessment, covering both gears and bearings, underpinned by Romax. "We value Romax as a powerful calculation tool in line with global technical standards such as ISO (International Organization for Standardization) and AGMA (American Gear Manufacturers Association). Over the years, the value of Romax has increased through additions and upgrades including on their NVH, Finite Element (FE) analysis, and efficiency capabilities. For gear design, Romax is the most effective and powerful package I have ever used."

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Since the time of writing this case study, the Romax product offering has evolved. Romax Concept retains its name, but the features and benefits described as part of RomaxDesigner are now available within new products in the Romax portfolio.



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Romax, part of Hexagon's Manufacturing Intelligence division, provides world-leading solutions for the design, analysis, testing and manufacture of gearboxes, drivetrains and bearings. Learn more at romaxtech.com. Hexagon's Manufacturing Intelligence division provides solutions that utilise data from design and engineering, production and metrology to make manufacturing smarter.

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