

# IMPROVING GEARBOX OILING DESIGN

## HYCET USES NANOFLUIDX TO IMPROVE GEARBOX EFFICIENCY AND AVOID MECHANICAL FAILURES

### About the Customer

HYCET Transmission Technology Hebei Co. Ltd (HYCET) is a comprehensive enterprise focusing on E-drive systems. HYCET designs and manufactures transmission systems for both pure electric vehicles (EV) and hybrid vehicles (HEV), and its products meet the needs of vehicles from A0 class to medium and large SUVs. The research and development center covers both domestic and foreign vehicle transmission systems and can perform simulations and experiments from the component level to the full-vehicle level.



In the past, gearbox oiling mainly relied on physical tests and engineer experience, and the design cycle was long. Using Altair's latest CFD simulation technology, engineers now have a deeper understanding of the complex two-phase flow phenomenon in the gearbox, which helps us optimize our products.

Cui Jin, CAE simulation engineer, HYCET



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### Their Challenge

HYCET needed a way to troubleshoot gearbox mechanical failures (such as pitting, erosion, and peeling), mostly caused by insufficient lubrication. In addition, since E-drive speed can reach up to 20,000 rpm, HYCET needs to be able to properly calculate churning losses. It must also consider windage effects, oil volume, and the amount of air bubbles (aeration) present in oil.

### Our Solution

To address its problems, HYCET adopted Altair solutions – which combine smooth particle hydrodynamics (SPH) with GPU hardware to streamline innovation and problem-solving. HYCET primarily utilized Altair® nanoFluidX® and Altair® SimLab® throughout the process. With SimLab, a powerful pre-processing solution, the team created smoothed-particle hydrodynamics (SPH) models from complex raw CAD geometry in less than a day and was able to define physical and numeric parameters. In addition, the team could submit calculations directly from local and remote GPU servers. And although physical testing is still an important part of the product design process, nanoFluidX gave the HYCET designers more insight into complex flow phenomena and helped the teams answer vital questions such as:

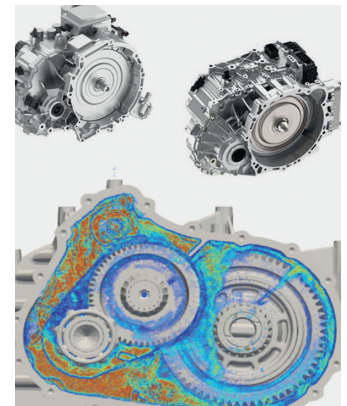
- Where are oil droplets from oil sumps and injectors coming from, and where are they going?
- Why is the oil path not flowing as intended?
- How can we address an oil collector installed at an inclined angle?
- How can we address and mitigate potential oil leaks from breathe holes?

Moreover, nanoFluidX allowed the team to assess multiple different scenarios. The solution enabled HYCET to determine how volatile high RPM flow fields are, how gear rotation pumps air bubbles into the lubrication oil, and more. This augmented the physical testing process with unprecedented power and accuracy.

### Results

With Altair solutions, HYCET can reduce physical gearbox testing while increasing the efficiency of its CFD simulations to include richer, more detailed oiling information including flow rate, hydrodynamic torque, fluid contact time, heat transfer coefficient, and more. Altair's solutions also helped HYCET significantly reduce design turnaround time and reduced costs by giving designers more insight into other aspects such as oil flow path, lubrication and cooling effects, and oil volume. Now, HYCET can design better, more efficient gearboxes in less time and at lower costs.

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**LEFT:** Snapshot of transient oiling in gearbox (HYCET transmission products) **RIGHT:** nanoFluidX allowed the team to assess multiple different scenarios such as the time averaged oil fraction distribution.

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