

Internal generating grinding for quiet planetary gear sets

A recent study undertaken by the Machine Tool Laboratory of the RWTH Aachen examined the improvements in pitch error and runout in planetary ring gears that were finished by generative internal gear grinding. The results clearly showed a significant improvement in both gear tooth topography and pitch.

After grinding with Mitsubishi's generative internal gear grinding machine, total profile error (F_α) and total helix error (F_β) were reduced from up to 0.020mm to less than 0.004mm, resulting in an ISO Class 3 quality.

It certainly is not a surprise that internal gear grinding will improve gear quality. The question was how this would impact NVH (noise, vibration and harshness) in a planetary gearbox setup? Would the results meet the requirements for existing and future transmission requirements?

To answer these questions, a study was carried out by the FEV transmission design development team in Aachen. A simulation focussed on the influence on NVH between conventional manufacturing methods for Planetary Gear Systems (PGS) and the application of generating gear grinding in ring gear production.

A representative planetary set was designed and used in the simulation to find the influence of the manufacturing process on the system excitation mechanism (noise). Torque and speed sweeps were used to calculate the gear set system's dynamic response.

What did the simulation show? The speed sweep simulation indicates that acceleration levels on the housing were improved by an average 10.2dB / maximum 21.8dB by grinding the internal gear. The simulated torque sweep showed an improvement over the complete torque range and even up to 70% improvement at a torque level of 20% compared to the conventional manufacturing scenario.

Read the full article in [Transmission Technology International](#) magazine:

The title of the article:

Hard finishing

Internal generating gear grinding as a hard finishing process enables significant noise, vibration and harshness improvements in EV transmissions

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