KISSsoft
Drivetrain Design Solutions

Function follows form: tooth form optimized, function improved

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Flank modified, wear reduced

Plastic gears are usually produced in large numbers and therefore in an efficient injection molding process. Due to hygiene requirements or to further reduce costs, they are often used without lubricants. This results in wear as the dominant damage mechanism. Wear as such leads to reduced load capacity, higher vibration levels during the mesh and contamination of the environment. On the other hand, small but artfully executed changes to the tooth form can greatly reduce this wear. The changes are largely cost-neutral, both in terms of manufacturing and quality control.

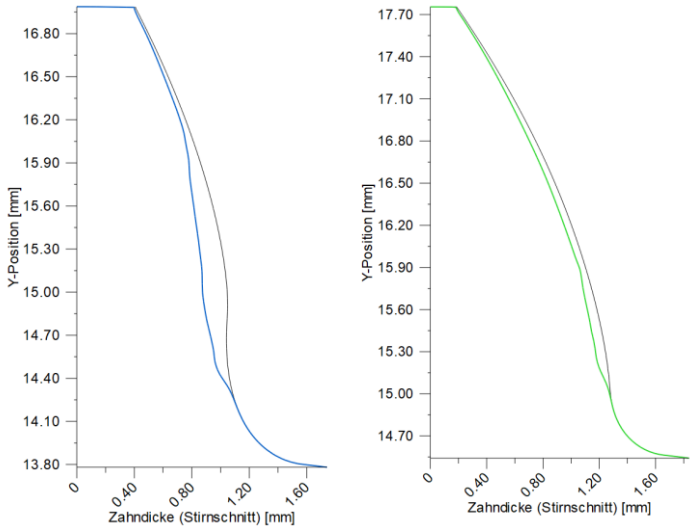

Bild 1. Links: Standard Zahnform resultiert in hohem Verschleiss. Rechts: Besser konstruiert hält länger.

The macro geometry changes in the mm range of tooth height, tooth thickness, profile shift, curvature, etc. are contrasted by changes, called modifications (micro geometry) here, in the µm range (crowning, tip relief, pressure angle modification, etc.). In both areas, changes are necessary, effective and they must be considered in combination. In the picture above on the left, the wear for the original tooth form is simulated, on the right the improvement for the modified tooth form (in terms of macro and micro geometry) is visible.

Root rounding optimized, service life increased

Like plastic gears, femurs, tree forks and tiger claws are beams loaded in bending with a variable cross-section and a fillet. While evolution has optimized the three aforementioned mechanical systems, it is the task of the designer to do so for gears in a shorter time compared to natural evolution. The approaches range from "gut feeling" to engineering rules to topology optimization through growth simulation. In each case, either the installation space or the material input is to be reduced, or the transmittable power is to be increased.

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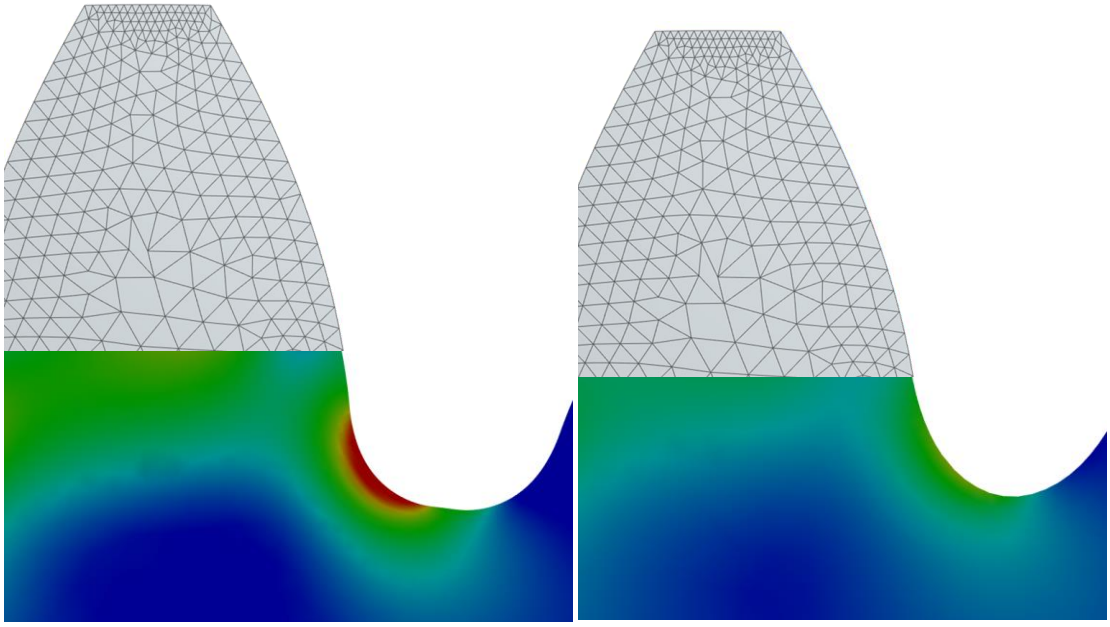

Bild 2. Links: Standard Zahnform resultiert in hoher Fussspannung. Rechts: Besser konstruiert hält mehr aus.

The picture above shows the reduction of the root stress by using a maximized rounding adapted with respect to the position and optimized in its shape. The possibilities in design have been greatly expanded by CAE tools, in contrast to which there are technical and commercial limits in manufacturing (narrow and thus expensive shape tolerances).

A gear engineer, equipped with specialist knowledge, the courage to be creative, the appropriate gear design software and experience, achieves such an improvement in an hour's work with software such as KISSsoft. The customer benefits are enormous: plastic gears are found in cars, vending machines, kitchen appliances, water meters or washing machines, where they move sunroofs, banknotes, whipped cream, clockworks or even laundry reliably, space-savingly, cost-effectively and quietly.