DASSAULT SYSTEMES

SIMULIA

Voith

Transportation & Mobility Case Study

FE Design

Efficiency on the road

Voith, leading specialist for automatic transmissions benefits from the optimization software Tosca Structure for development of its DIWA automatic transmissions. The increased efficiency sets new standards.

Energy Efficiency

Higher ecological and economical standards require more advanced transmissions to promote better fuel economy and lower emissions. As a competent partner for OEM and transport services Voith uses all of its resources to enhance the efficiency of its transmissions.

Material savings and reliability

Voith improved automatic transmission components – in this case the planet carrier – by optimization. One optimization goal is material savings by weight reduction. To further guarantee bearing durability and an equal load on the tooth flanks, the functional stiffness of the existing series should be kept.

Topology Optimization

The weight reduction of the planet carrier was achieved by topology optimization with Tosca Structure. In a first step, the available design space is defined by subtracting functional areas and joint spaces to connecting areas. The required functional stiffness is ensured by restrictions for the optimization. During the optimization, Tosca Structure identifies the areas that do not contribute to the force flux and removes step-by-step the material not required.

Manufacture-oriented design

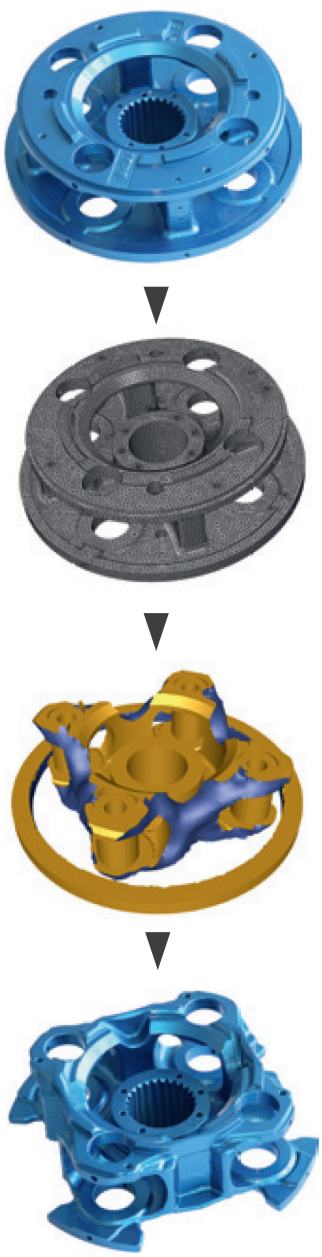
The requirements for the manufacturing process are directly taken into account, e.g. to guarantee demolding, during the optimization. The design proposal can be transferred to the CAD system and after just a few modifications a final design can be generated which meets casting requirements.

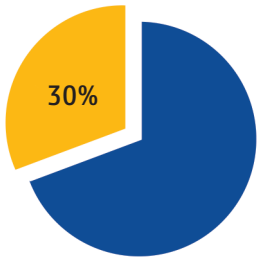
Optimum validation results

Finally the new design is validated by practical testing. All functional demands and structural durability were successfully proven.

This experience at Voith shows that designs which have already been optimized manually several times still contain significant optimization potential. Cast components especially may profit, with superior performance characteristics gained through an automatic and iterative structural optimization process.

Lightweight design using optimization technology





Material Savings

Competitive advantage–Efficiency in production and application

Weight reduction by more than 30%

The new design of the planet carrier generated significant savings in material, with a weight reduction of more than 30%.

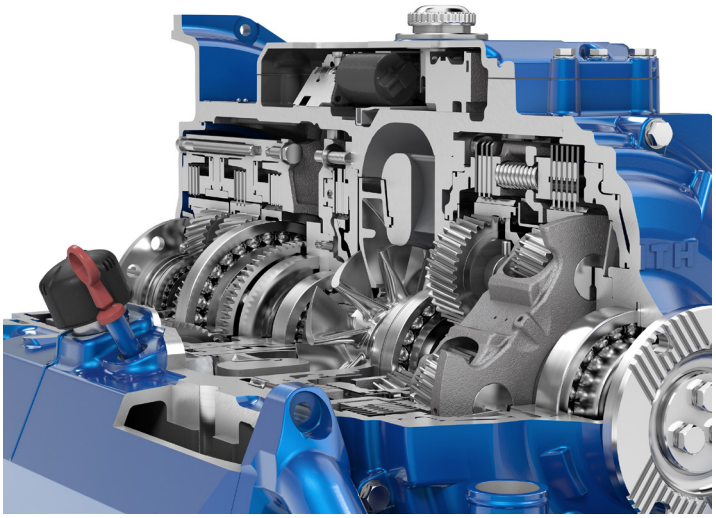
Optimized production process

The new compact design permits an additional component to be placed in the moulding box. As a result the same number of castings can be produced with fewer casting processes. By omitting the circular ring the chipping mass can also be reduced by 1,2 k g.

Robust Design

The new design fulfills all functional stiffness requirements, and proved to be exceptionally robust on the test bench.

The new design of the planet carrier maintained the required stiffness and lifetime, achieved considerable material and weight savings, and more economical production. Topology optimization with Tosca Structure led to higher quality and a significantly increased efficiency.



"By using Tosca Structure we found the best solution to realize material savings and increase efficiency in the product devolopment process of our automatic transmissions. Thus the topology optimization of our planet carrier resulted in a lighter and more robust design as well as significantly higher production efficiency."

Bernd Wöhrle,Technical Calculations
Bus Drive Systems, Voith

Focus on Voith

Voith Turbo, the specialist for hydrodynamic drive, coupling and braking systems for road, rail and industrial applications, as well as for ship propulsion systems, is a Group Division of Voith GmbH.

Voith sets standards in the markets energy, oil & gas, paper, raw materials and transport & automotive. Founded in 1867, Voith employs more than 42,000 people, generates EUR 5.7 billion in sales, operates in over 50 countries around the world and is today one of the biggest family-owned companies in Europe.

Headquarters: Heidenheim/Brenz, Germany

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