HENN is producing innovative connection technology including mufflers for the automotive industry (Fig. 1). Numerical prototyping was being considered in order to accelerate the development process while increasing product quality. Key applications involving miscellaneous physics had been selected:

1. strength and tightness of the closing mechanism,
2. flow induced deformations, pressure loss,
3. customization of the acoustic transmission loss.

These cases were given to CADFEM in order to allow for a progressive, safe and robust entry into numerical prototyping including pilot projects, know how transfer and software support.

**Task**

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Simulation by order of HENN GmbH & Co KG.
Optimization of connections and acoustic filters with multiphysics simulation

Solutions
ANSYS FEM structural analyses involving non-linear frictional contacts, hardening and hyper-elastic material laws were used to compute structural deformations, stresses and contact pressures under realistic conditions for the connecting mechanism (Fig. 2).

An ANSYS CFD analysis was used to compute pressure losses. The resulting pressure field was applied on a structural model in order to obtain structural deformations and stresses (Fig. 1).

Optimizations based on a parametric model of the acoustic transmission loss measurement setup allowed to generate custom designs automatically according to target transmission loss profiles (Fig. 3) and size reduction objectives.

Consulting projects were followed by know-how transfer that allowed engineers by HENN to run further simulations and perform virtual prototyping on their own.

Customer Benefit
In house virtual prototyping:
- ability to automatically generate custom muffler designs to address specific transmission loss requirements in a few days instead of a few weeks
- dramatically reduced number of prototypes, thus ensuring a short development cycle while reducing the R&D costs
- increased product quality while reducing production costs
- safe and progressive introduction of state of the art simulation technologies thanks to a dynamic trade-off between the use of CADFEM and in-house resources.

Fig. 2: Structural stresses and deformations of connector mechanism and muffler.

Fig. 3: Optimized acoustic spectrum according to a given target including comparison between simulation results and subsequent measurements (4 points sound pressure level transmission loss from a test rig).

About CADFEM
Founded in 1985, CADFEM provides everything that is required for the success of the simulation from a single source: First-class software and complete, ready-to-use systems; comprehensive services; the latest knowledge. CADFEM is one of five ANSYS Elite Channel Partners, the only in Europe.