

CADFEM Consulting

Transient analysis of a scroll compressor with ANSYS®

Fluid loading on moving enclosures

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Task

The scroll compressor consists of a stationary and a rotating spiral, which are nested. During the movement of the rotating spiral, the number, shape and volume of the internal chambers is constantly changing. Consequently, the pressure conditions in the chambers are changing as well.

The aim was to investigate the following aspects using FE simulation:

- Realistic compressor kinematics
- The internal pressure calculation and application of the continuously changing chambers using analytic approach instead of using traditional FSI approach
- Transient effect at high speeds

Solution

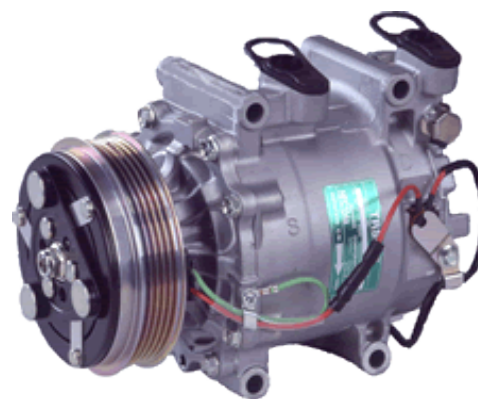
First, it was necessary to automatically detect the varying number of chambers, their shape and also their seclusion. An extended polygon-recognition was also required to study the areas of pressure generation.

Some APDL routines have been developed and integrated as Command Objects in ANSYS® Workbench™. Joints that resulted from the multi-body simulation and nonlinear contacts served to model a realistic compressor with complex kinematics. With the help of ANSYS® HPC the time to calculate the transient analysis could further be reduced.

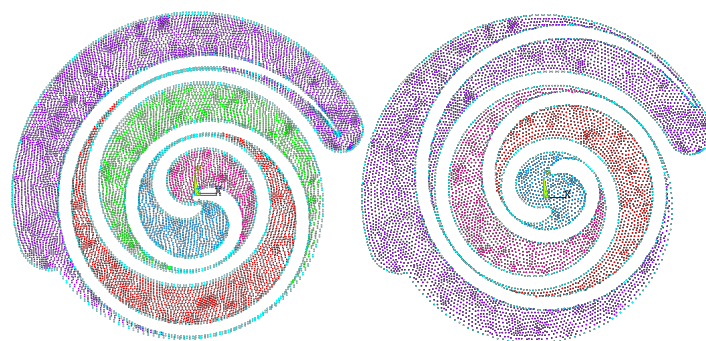
Customer Benefit

Previously it was necessary to model the pressure generation chamber accurately in a CAD system for each rotation angle. The pressure must be "calculated by hand" and transferred manually – a tedious and error-prone process.

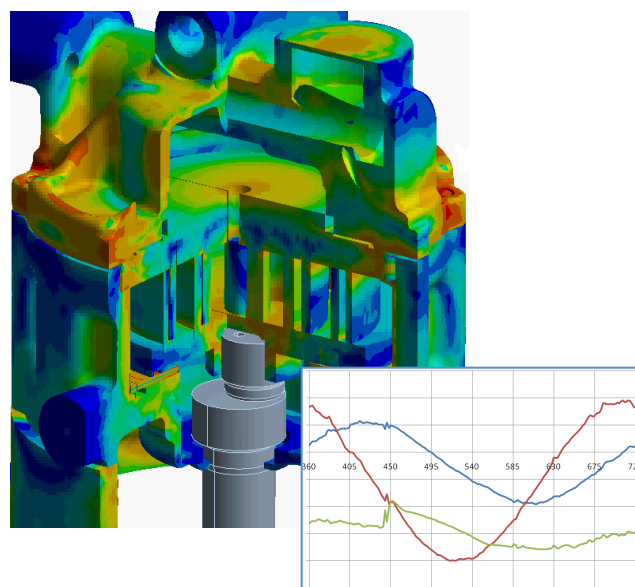
- Using the automated chamber detection, the customer can calculate the angle of rotation for all simulations much faster.
- The very realistic kinematic model can achieve more accurate results.
- The use of ANSYS HPC reduces the overall simulation time.



Scroll compressor



Automatic chamber detection and polygon-recognition at two rotate positions



Transient analysis results

Figures Courtesy of Sanden Technical Center GmbH