

Configuration of Brake Components

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ABSTRACT

The hydraulic brake products like brake calipers, master cylinders and boosters are the foundation of today complex vehicle brake systems. The state of the art application leads very often to an individual design, due to the fulfillment of customer requirements within the available installation space.

Also the enormous pressure on cost and time require optimized design processes.

Therefore Continental developed the product configuration software CoBra. Within this software tool, the engineering is able to react very fast on demands. Starting with the brake sizing parameters and the customer interface definition, CoBra supports the design engineer to select the necessary components and positioning them accordingly, considering the actual design standards.

The data based configuration software collects all necessary design parameters and provides an export to parametric CAD start up models. Therefore a high level of data quality can be achieved which allows to couple further design and simulation modules.

Today all caliper types and the master cylinders are part of the actual software version.

In summary we can state that CoBra, as the basis for the start of each caliper application, has a high impact on the standardization approach. The early integration of design rules, manufacturing standards and the attached CAD / CAE process reduces failure modes and gives the engineering more time to concentrate on the project specific optimizations.

CITATION: Ungethuem, U. and Simon, D., "Configuration of Brake Components," *SAE Int. J. Commer. Veh.* 8(2):2015, doi:10.4271/2015-01-2668.

INTRODUCTION

The hydraulic brake products like brake calipers, master cylinders and boosters are the foundation of today's complex vehicle brake systems. The state of the art application is very often an individual design, due to the fulfillment of customer requirements within the available installation space.

Increasing cost and time pressure leads to optimize processes, to gain flexible solutions for the customers. To meet the design requirements, HBS has developed its product configuration software (Fig 1.). This software, in the following named as config-tool, allows the development to create the product layout and CAD model more efficiently.

On the basis of the highly integrated design process several simulations based on the parameter set as well as on the CAD Layout are associated.



Fig. 1. Product configuration software

BACKGROUND

Since 3D CAD modeling started at HBS in Catia V4, the methodology department started to develop an efficient way to design brake and actuation components in the CAD modeling system.

By starting the utilization of Catia V5, a standard product specific methodology training for the design departments was rolled out worldwide at HBS (Fig. 2).

Prerequisite for an highly integrated configuration software is to have a common modeling language in the 3D CAD system installed.
Therefore the product specific design methodology was developed.

- Prepared startup models reducing design effort and failure mode
- Startup Models considering actual knowledge and design standards
- Training manuals for all hydraulic brake components are available

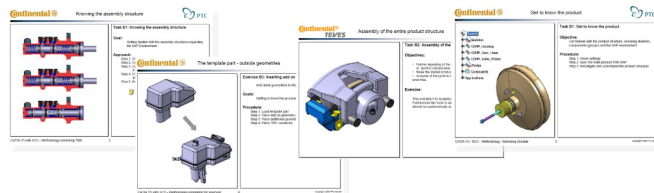


Fig. 2. CAD product methodology training

The CAD product methodology is the basis for the implementation of parametric design and knowledge ware. It allows also the interaction by interfaces to external programs and the associative connection to CAE software.

Within the layout phase for an example a caliper, many software tools are being used at HBS. Starting with the brake system layout based on internal simulation standard, linear FEA, topology optimization, non linear FEA and multi body motion software are used.

The article describes how the tools are placed in a highly integrated design process (Fig. 3).

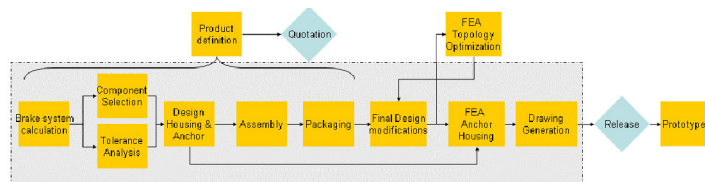


Fig. 3. Configuration Process

PRODUCT CONFIGURATION PROCESS

1. Configuration of the BOM

Beginning with the main input parameters coming from the brake system layout and the interface definition, the design engineer starts to configure the BOM under consideration of technical characteristics of the brake components (Fig. 4 and 5). The technical characteristics like material and major dimensions are maintained in a database which is connected to the configuration software.

To reuse the products and the components in several configurations the master data and the life cycle states are synchronized with Continental's PLM system by its part number.

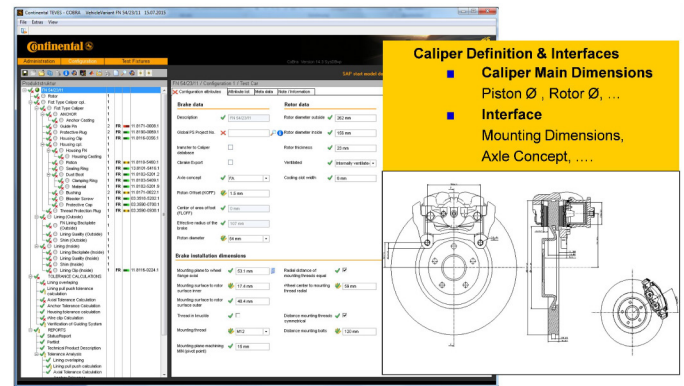


Fig. 4. Configuration set up

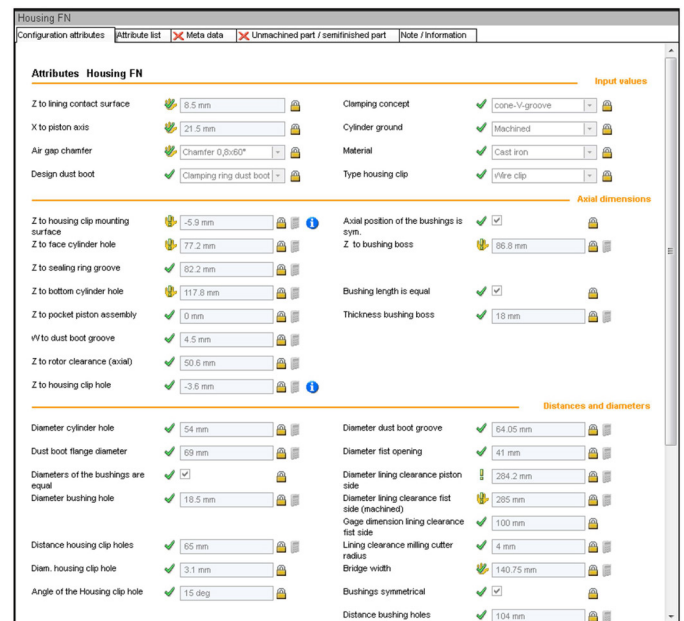


Fig. 5. Component characteristics

The software calculates the dimensions for the individual castings and defines the positions of the selected components. The reuse of the components is controlled by the config-tool. Therefore the design engineer gets at first the selection of preferred components. In advance it can be searched for possible alternatives by identifying the proposed characteristics from the config-tool. The aim is to introduce a high worldwide reuse of standard components defined by the component families.

After finishing the BOM, the config-tool calculates all tolerance cases and refines project individual dimensions.

Due to this process the design engineer is supported by the tool, using several features like parameter locking, predefined values, recalculation of values and highlighting of configuration conflicts (Fig. 6).