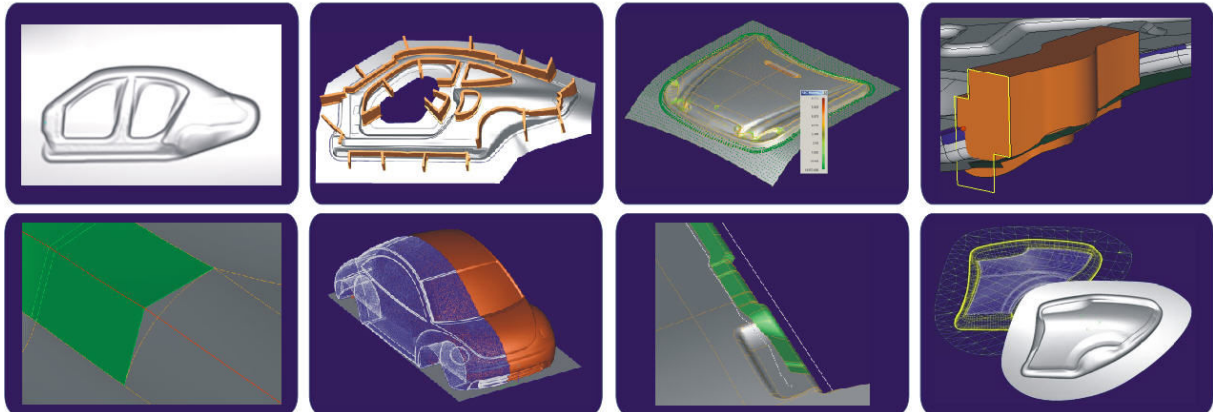


panelshop™

Solutions 2009

panelshop™ Tools for the Toolmaker



Version 9.0

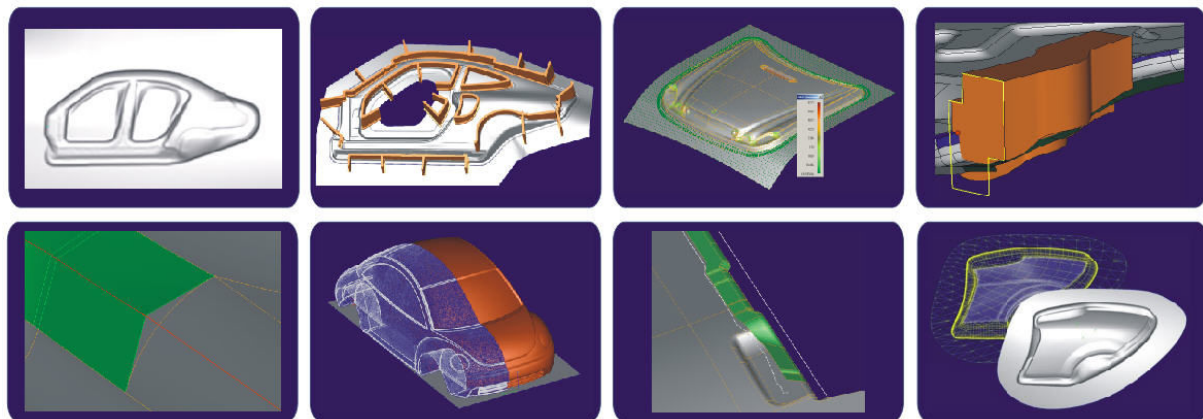
30. January 2009

With the assistance of excellent tool and die shops we develop mathematical methods and parametrical models to solve complex tasks of tool design. Thus, we are able to arrange virtual parametrical design very simple and close to practical use. Our solutions are mostly fully automated.

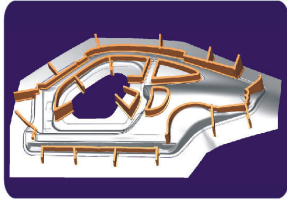
panelshop and its special solutions is an outstanding completion to established CAD-systems. Model-data can be imported by the use of powerful translators. The resulting features are exported without any trouble.

panelshop is also distinguished by its tolerant methods to handle incoming data: At the early beginning of tool design 3d part and planning data often are simplified and fragmentary. panelshop offers robust and easy to use methods, which guaranty an efficient workflow with this kind of unfinished data.

Following solutions are available:



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1 Trim Steels

This software tool automatically designs the complex base bodies and all extensive active faces needed to define trimming steels used to trim sheet metal and also plastic parts. New mathematical methods have been developed and implemented to create 3d offset curves and faces. Today's segmented and very time-consuming manual design procedure is replaced fully.

Benefits

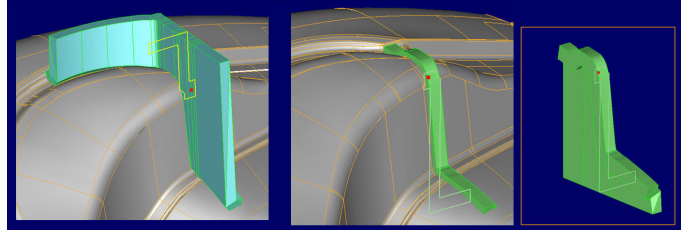
- The workload is reduced about 95%. The definition and calculation of all trim steels for the Porsche side panel - shown in the picture above - now needs less than 2 hours (before: 40 hours).
- Beside the trim steel casting body the active faces needed for machining are also computed automatically. Four different shape types are available to fulfil all known guidelines: A "V"- a "Double V"- a "Straight"- and a "Step"-shape.
- To satisfy machining conditions the active faces will automatically be adjusted to prevent collision and back-draft
- The guaranteed optimal oversize of the created casting bodies and the also optimized size of the active faces minimizes the machining time a lot.
- Because of the automated procedure the quality of the resulting data is secured and reproducible.
- Using the software is very easy, the training effort less than half a day

Additional Notes

The trimming curve, die faces and the working direction are needed to set up the calculation. The user only has to adjust the dimensions, before the calculation is done automatically. The result consists of the base body as solid and the active faces. All these features can be exported by the use of various translators.

One essential advantage is the applicability to scrap cutting steels (see picture above). Both, the upper and the lower tool, which differ from each other, will be calculated automatically.

*Scrap cutter along a sharp-
edged (90°) trim curve,
upper tool (left) and lower
tool (right)*

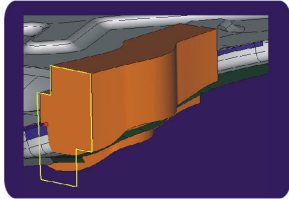


Development Partner

Design methods have been developed (2005-2006) with the strong and competent support of August Läßle GmbH & Co KG.

CATIA V5 – Porting

In collaboration with CENIT (Gold partner of DASSAULT SYSTEMS) the porting to CATIA V5 has been done. The first version of TSE software (**Trim-Steel-Editor**) was released in August 2007. Among other things in 2008 the segmentation of the steels was implemented. Current developments in 2009 add the parametrical design of the trim steel base.



2 Restrike Tools

The base bodies of restrike tools - to be used for sheet metal parts - will be generated automatically. New mathematical algorithms have been developed to handle special conditions: The design is determined by two leading 3d curves, which was a new challenge for automatically calculation (the trim steel design runs along one curve). New methods have been developed in addition: a consistent tangential extension for multiple parts boundary curves.

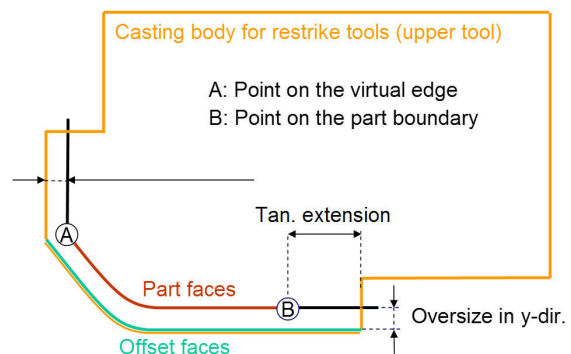
Advantages

- The workload was reduced about 95%.
- The optimal size of the casting body minimizes the machining effort a lot.
- The fully automated procedure secures the quality of resulting data: Casting oversizes will also be guaranteed in complex geometrical areas.
- Ease of use. The training effort is around 2 hours

Additional Notes

Upper tool: In comparison to the trim steel calculation, the design of restrike tools is determined by two 3d curves. Curve A, which normally is created by virtual edges (along a chain of blending faces) and curve B that represents the part boundary.

Section of the upper tool, curve A and B are displayed as intersection points



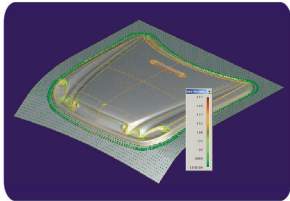
To define restrike tools two additional surface operations have been implemented:

- Tangential extension of the part boundary faces (see picture above). The part boundary faces (curve B) will automatically be extended to the outside with a constant user defined value. The resulting faces can be joined.
- Offset-face (see picture above). The part boundary faces and the new extended faces will be combined to automatically compute one offset face. This face is needed to trim the casting body. It will ensure a constant casting oversize.

Lower tool: To design the lower tool tangential face extensions are created around the whole part. All holes in the part can be closed automatically.

Development Partner

The design procedures have been developed (2006-2009) with the strong support of the excellent tool and die shop of August Läßle GmbH & Co KG.



3 Auto SBC (Springback Compensation)

Auto SBC is a short form for "**A**utomated **S**pringback **C**ompensation". The target is to transform a set of given trimmed spline faces onto their deformed mesh surface. The tool can also be used for other similar applications (e.g. compensation of elastical tool bending).

Benefits

- The procedure is fully automatic, only the input data has to be read in.
- Minimized calculation time. The face transformation of the example shown in the movie (see web-site: Front hood of DaimlerChrysler) takes about 13 min.
- High quality of face data: Accurate representation of the deformed mesh. Skinable (transition tolerance of 0.01 mm) face model.
- Fixed faces that have not been modified within the FE-optimization process will also not be modified.
- Symmetry is supported.
- Applicable to spring forward analysis because of robust extrapolation scheme.
- Very easy to use. Half an hour briefing should be enough.

Additional Notes

In addition to the given spline face model - as a prerequisites for the applicability - a vector field or two compatible mesh surfaces (that are internally used to calculate the vector field) are needed.

This software solution has been developed to be used in combination with FE-software like AUTOFORM, PAM-STAMP or LS-DYNA. The FE-Analysis is used to determine the new surface of the compensated tool represented as mesh surface. The data of the mentioned FE-software tools can be used as input data without any problems.

Because of global treatment of the problem the algorithm is robust with respect to inhomogeneous and incomplete data. Thereby three often occurring problems are solved automatically:

- The vectors must not start exactly on the given CAD faces.
- The vector field can be inhomogeneous and it might possess arbitrary holes. In this case an interpolation between the existing vectors will take place.
- The vectors must not cover the whole part, it is enough to get them only on the trimmed part area (for example: Result of any spring-forward analysis). In this case also the outer regions of the die can be transformed using a slightly abating transformation field.

Development Partner

The main procedure has been developed from 2005 to 2009 with the competent support of ESI-GROUP. The application has been tested and optimized with PAM-STAMP/OUTIFO.



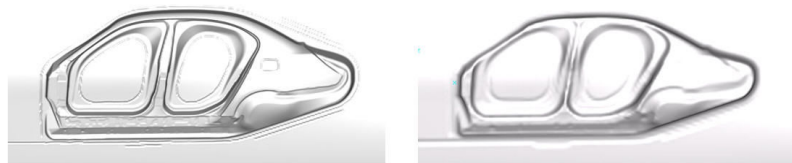
4 Offset (for Casting and Material Thickness)

To start the design of casting bodies in a very early stage of tool development offset faces for large offset values (around 50 mm) can automatically be created. To handle small offset values in the range of material thickness an additional procedure was implemented. The picture above shows an offset face (60 mm outside) for a side panel.

Benefits

- Fully automated, easy to use
- Robust with respect to holes and discontinuities between and within the given faces
- Resulting faces with small data size
- Automated calculation of a zero face (offset distance = 0 mm)
- Use of mesh data also possible e.g. from FE-software-tools like DIEDESIGNER (AUTOFORM) or PAM-DIEMAKER (ESI-GROUP) or other similar software.

*Zero face (0 mm)
and 60 mm offset
inside*

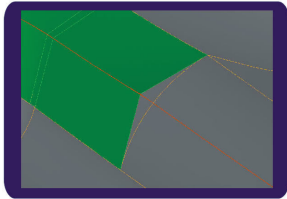


Additional Notes

The resulting offset surface (in case of large offset for casting) is represented by one single spline face. Optionally it can be split automatically into arbitrary pieces like a checkerboard to optimize data handling for the target CAD-system.

Development Partner

These procedures have been developed from 2002 to 2003 with the kindly support of ThyssenKrupp Drauz Nothelfer.



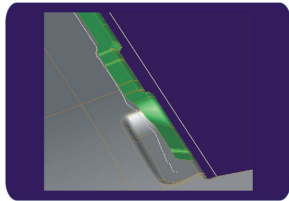
5 Virtual Edges (and Radius Downsizing)

Spline face models of sheet metal parts often do not contain all base surfaces that are needed to recover virtual edges (also called "theoretical edges"). One possible reason is that the face model has not been designed by parametrical methods. This is due to the fact, that the data origin often is a physical clay model. In this case the derived spline faces do not have linked any base surfaces that meet in the virtual edge. Another possible reason is that the base surfaces have been lost due to the translation of the data between several CAD systems.

However, for several issues in tool design virtual edges are needed and also the additional faces that meet in these virtual edges (see figure above). A similar task in this context, which uses internally the same algorithms, is to smaller radii. This is important to locally free some blending areas of the punch or die.

Benefits

- Extremely simple and intuitive, fully automated.
- The resulting curve segments that define the virtual edge will automatically be joined to be one continuous 3d curve
- Automatic downsizing of radii for a given chain of blending faces by a given distance value



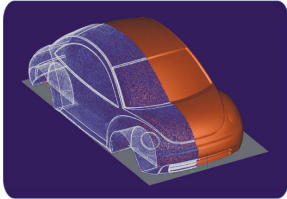
6 Trim Curve Calculation

As a first approximation of the trim curve (that lies on the die) often a "winding off" method is used. This procedure in standard CAD systems often is not supported very well and it additionally needs a lot of manual work and calculation time.

The current module of **panelshop** offers a pure geometrical solution to determine trim curves: Flange boundary curves will be winded off in planar sections of any predesigned spine curve onto the surfaces of the die. The result is a spline curve and/or a sequence of points that represents the trim curve.

Benefits

- Easy to use, no training required.
- Short calculation times



7 Reverse Engineering

3d point- or mesh data can be transformed to spline faces. The use of trimmed surfaces and an internal powerful healing algorithm enables a very flexible design of large faces: The manual workload could be reduced to sketch face boundary curves.

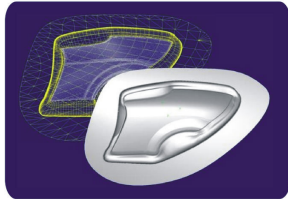
Benefits

- Simple intuitive handling.
- A new powerful healing algorithm automatically recalculates (epsilon-C2) transitions between computed faces.
- High design flexibility: Use of trimmed faces enables the user to sketch an arbitrary number of curves (2-25) to define face boundaries.
- High design flexibility: T-joins enable local refinement of the face patches - to adjust face design to given local geometry
- Existing spline faces can be included in the creation of new faces

Additional Notes

The topology correlation between closed loops of curves and the new faces will be computed automatically. This is needed to also automatically readjust transitions between faces.

The algorithms are robust against noisy data (if the mesh or data come from any measurement device) and inhomogeneous distributed point or mesh data. The resulting face model will be suitable for solid modelling - according to the user defined tolerances.

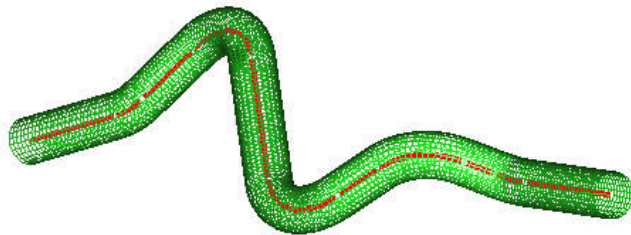


8 Mesher (for Spline Faces and Tubes)

The integrated mesher was developed to mesh any type of CAD-faces. Several options like "edge length" or "normal deviation" can be set to adjust the mesh to the users needs. The computed meshes can be exported by the use of several typical FEA formats (see Data Translators for more details).

To efficiently set up a FEA for tube bending processes a special tube mesher has been developed.

Tube mesher: Needs the same input data as a bending machine - poly line and radii



In addition to the input of the poly line and the radii the user has to determine the mesh size. A process adjusted mesh will be calculated automatically.

Benefits

- Easy to use
- Robust
- Includes a special tube mesher

IGES STEP VDA
CATIA V4/V5
PROE UG

9 Data Translators

panelshop uses the CAD-kernel ACIS and also the CAD-translators from SPATIAL. Today SPATIAL belongs to DASSAULT SYSTEMS.

The following translators are available in panelshop for im- and export of data:

- CAD-translators: IGES, VDA, STEP, SAT, CATIA V4, CATIA V5 (UG and PROE on request)
- Mesh-translators: STL, WRL, PAMSTAMP, AUTOFORM, ANSYS, LS-DYNA, NASTRAN

Note: The CAD-translators have to be licensed separately, the mesh-translators are included in the accordant modules.