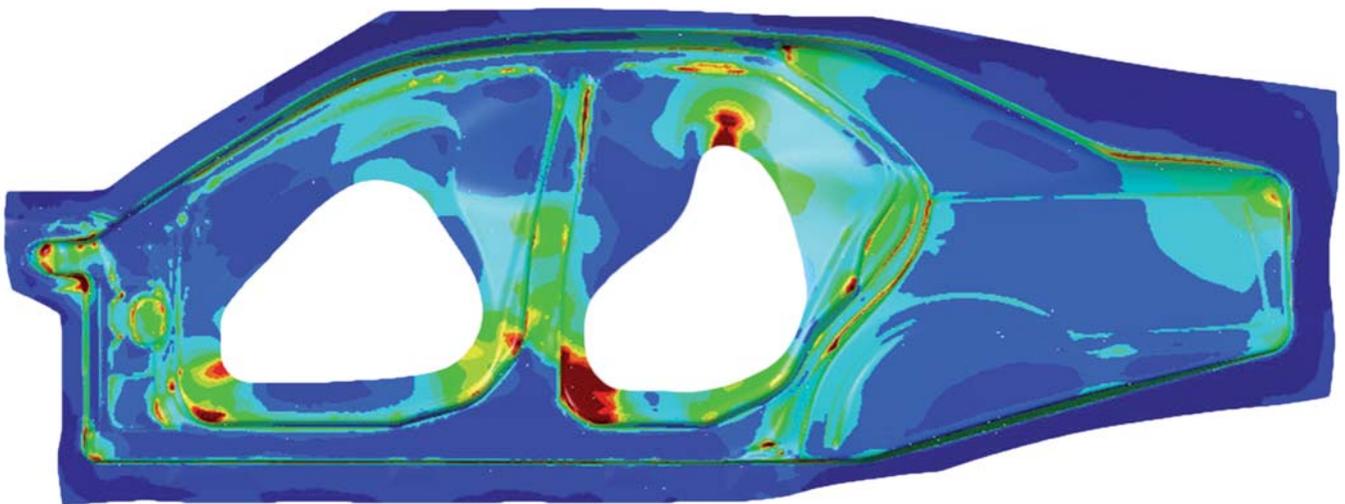


eta/DYNAFORM

Die System Simulation Solution



Reduce Tryout Time, Lower Costs and Improve Quality

Complete Die System Simulation Solution

DYNAFORM is the complete die system simulation solution. DYNAFORM allows the organization to entirely bypass soft tooling, reducing overall tryout time, lowering costs, increasing productivity and providing complete confidence in die system design. It also allows evaluation of alternative and unconventional designs and materials for an optimal solution. The most cost-effective and accurate solution available, DYNAFORM is the clear choice among progressive organizations seeking to streamline the die analysis system.

One Simple Interface

DYNAFORM encompasses the entire die system process in one simple interface. By simulating every detail during the design stage, DYNAFORM ensures the highest quality formed part and best manufacturing process. The system guides the engineer through cost estimation, quoting, die face design and formability analysis. Then, in a virtual environment, moves the part through the stamping process inside the plant – station by station. DYNAFORM simulates trimming/shedding and scrap removal and analyzes die structural integrity. Finally, DYNAFORM evaluates the part transfer process within the die system and simulates the behavior of the part during shipping.

A Solid Infrastructure

DYNAFORM offers NURBS based CAD surfaces capability. This allows DYNAFORM's mesh-based technology to maintain full parametric associativity throughout the entire simulation process. LS-DYNA, the most powerful solver in its class, is the engine within DYNAFORM. Offering tremendous calculation power to support difficult modeling and simulation challenges within a die system, these powerful processing and solving technologies enable DYNAFORM to meet the needs of users today and those in the future.

The Most Accurate and Cost-Effective

The clear price/performance leader in the industry, DYNAFORM offers pin-point accuracy in every detail and is the key reason die designers all over the world have turned to DYNAFORM for the most precise analysis possible.

Features

- Blanking and nesting
 - Blank outline & cost estimation
- Die face engineering
 - Binder development, addendum generation and drawbead layout
- Sheet metal forming, tube bending and hydroforming
 - Deep draw and stretch forming simulations
 - Progressive die line and transfer die line simulations
 - Trim line evaluation
 - Material evaluation
 - Springback and springback compensation
 - Tonnage prediction
- Die structural integrity
- Sheet metal transferring/handling
- Scrap shedding/removal

Benefits

- Reduces cost
 - Avoid costly design flaws
 - Reduce scrap
- Reduces development time
 - Tryout time
 - Re-tooling
- Improves quality
 - Simulation analysis provides greater confidence in die design
 - Eliminates marginal or flawed tooling

LS-DYNA

The powerful dual-solver is the engine that powers the efficient processing environment of DYNAFORM, making it a complete simulation solution package. LS-DYNA uniquely offers both explicit and implicit solutions that can be seamlessly switched to correctly simulate the physics of virtually all engineering concerns of a die system including formability, springback, springback compensation, trimming, and flanging.

Blank Size Engineering (BSE)

The BSE module is a complete solution for accurate blank size estimation, nesting to maximize material utilization, piece price and scrap calculation. BSE is based on a one-step algorithm for rapid calculation. Potential forming failure due to excessive blank thinning is detected through an inverse method. BSE also creates a forming limit diagram (FLD) map for feasibility review.

Die Face Engineering (DFE)

Based on the product design of a panel, the DFE module offers capabilities of both CAD surface and CAE meshing tools. DFE Interactively generates binder surfaces, addendum profiles/surfaces, PO Lines and layout drawbeads with full associativity between FEA mesh and surfaces. A preliminary die face is created for further formability studies with an iterative process until die face validation is achieved.

Formability Simulation (FS)

The FS module is a complete incremental die simulation program for quickly generating formability results at a very early stage of the product design cycle. It is suited for design feasibility analysis and verification. Stress, strain and thickening results are plotted and a complete forming limit diagram (FLD) is generated. It is a proven tool for uncovering hidden problem areas.

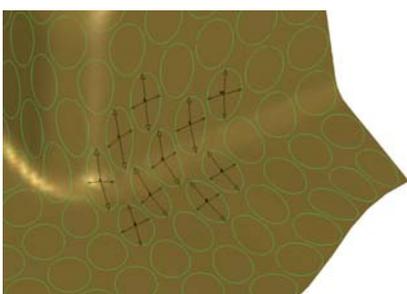
Die System Analysis (DSA)

DSA offers an LS-DYNA based FEA solution to analyze die system operations including scrap shedding/removal, die structural integrity and sheet metal transferring/handling. Further development will include trimming, flanging and hemming operations.

POST

DYNAFORM offers a wide variety of visualization tools for the interpretation of the simulation results. These results include traditional animations, the forming limit diagram (FLD), thinning maps, stress/strain maps, circular grid, material draw-in, skid mark, face reflection and stoning.

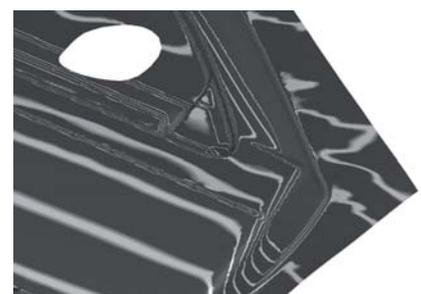
- **Material Draw-in**
The material draw-in map shows the metal flow-in of the blank during the forming process. The material flow map indicates the need for an adjustment of the drawbead design layout. The Post creates an iterative study that can correctly and quickly generate a group of drawbead layouts that can produce a balanced and evenly stretched panel.
- **Forming Limit Diagram (FLD)**
The FLD provides an overview of the forming modes and indicates regions of splitting, wrinkling and under-stretching. Combined with other post-processing data, the die design feasibility can be correctly assessed.
- **Circular Grid**
Typically done on the shop floor, the circular grid analysis examines the detailed stretching and direction for a local region.
- **Face Reflection & Stoning Examination**
Face reflection analysis is commonly used to visualize unevenness of panels with Class-A surface requirements and DYNAFORM performs this in an analytical environment. A further refinement of the face reflection analysis, the stoning examination offers quantitative results i.e. depth, length and shape of a defect in a local region.



Circular Grid Analysis



Stoning Examination



Face Reflection

Beginning with the 3-D part geometry, BSE can quickly unfold the flanges and flatten the geometry to produce a blank outline for blank size estimation along with piece price and scrap calculation. Product feasibility and cost analysis can be thoroughly evaluated using BSE.

Part Preparation - Surface Separation

The top and bottom surfaces of a solid-model part can be separated, showing the material from both inside and outside and the mean (middle) surface can be generated automatically. There are also multiple functions to repair surface defects.

Blank Development

BSE includes an industry proven solver (MSTEP) for the accurate prediction of flat blank profiles from 3-D part geometry. Designed for cost estimators, blank predictions consider both linear bends and the material stretch that occurs during the forming process to produce the most accurate blank possible.

Nesting

The BSE module provides for 1-up, 2-up and multiple blank nesting. The material usage and fall off is calculated along with piece price. Minimum required blanking tonnage is estimated. Nesting optimization can be performed to calculate the best material utilization.

Cost Estimation Report

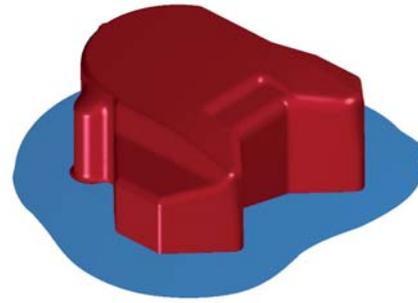
Automatically generate reports for cost estimation and quotation of the part material. Report output includes detailed descriptions of overall blank size, nesting configuration, pitch, coil width, material utilization, number of coils required to meet annual volume and total piece price for materials.

Feasibility Study using MSTEP

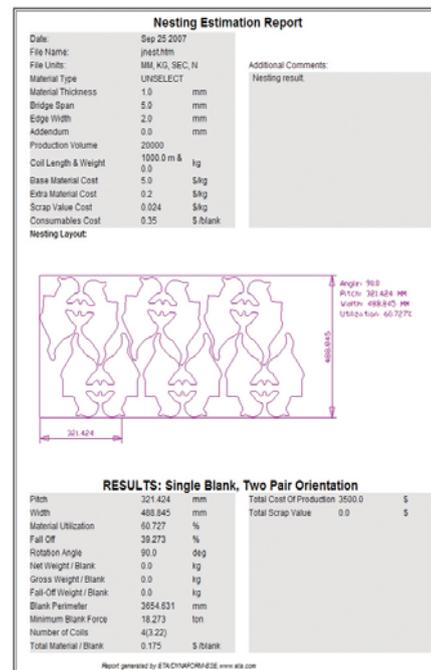
MSTEP is a one-step code which can be used for quick formability of a part. Binder, addendum and drawbeads can be simulated with pressure pads, binder and drawbead force.

Trimline Development with MSTEP

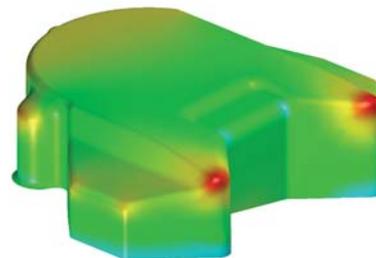
MSTEP will quickly and easily develop the trimline throughout multiple stations.



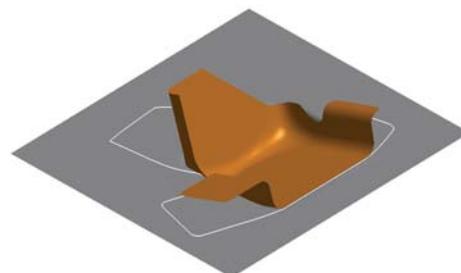
Blank Development



Cost Estimation Report



Formability Simulation

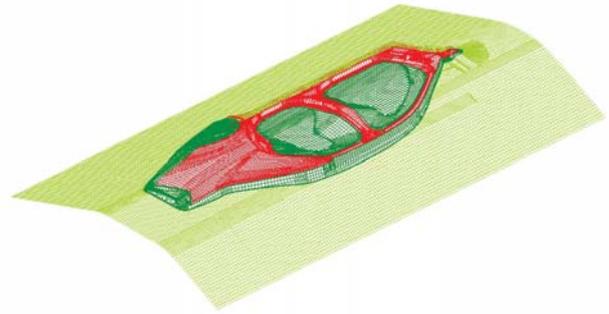


Trimline Development

Using automated tools in both CAD surface and CAE mesh environments, DFE generates binder surfaces, addendum profiles/surfaces, PO line and layout drawbeads. Compatible with major CAD codes, high quality CAD surfaces (NURBS Surface Based Infrastructure) are produced throughout the DFE module.

Automated

Automated tipping, reverse trimming, undercut/draw depth calculation, filleting and unflanging functions minimize the work required to design the die from the part geometry. Automated and flexible tools, such as morphing capability, are provided for binder surface and addendum profile generation, as well as fine adjustment.



Binder, Addendum & Drawbead Geometry

Binder and Addendum Generation

Based on part geometry, various CAD surface generation tools are provided to create, edit and morph the CAD surfaces to generate desirable binder surfaces. The advanced addendum generator creates a series of profiles based on draw depths and the shape of the part between the binder and the die cavity. The profiles are then meshed and surfaced to create a complete addendum for forming. Profiles can be edited using interactive functions or by adjusting the shape of the PO line.

Parametrical Definition

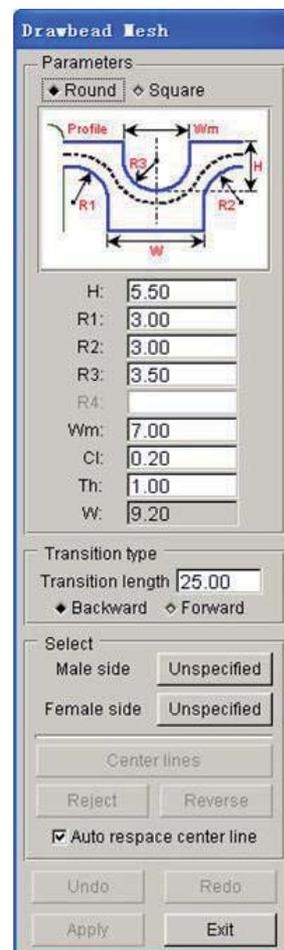
Addendum profiles and geometry drawbeads are parametrically defined. Quick adjustments are then possible by editing parameters.

Associativity

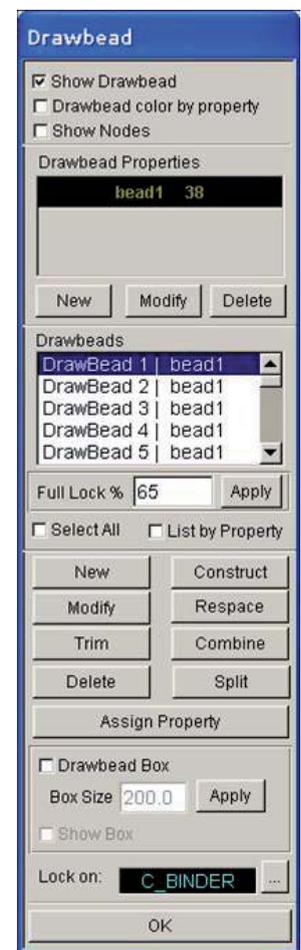
Since all surfaces and profiles are parametrically defined; the binder surface, addendum profiles/surfaces and PO Line are also fully associated. Therefore, modification of one entity can be extended to the other entities due to the associativity characteristics.

Geometry Drawbeads (DFE and FS)

The geometry of the drawbeads have a great deal of influence on the accuracy of the springback results. Within DFE, the commonly used drawbead geometry can be parametrically generated and interchanged with the analytical (line) drawbead. This capability can be customized for various drawbead designs/applications.



Geometry Bead



Line Drawbead

The Formability Simulation module uses LS-DYNA for accurate physics modeling, efficient calculation and in-depth simulation of the formability based on the die face design. The FLD (forming limit diagram), thinning map, wrinkling, material draw-in, circular grid, light strip and skid mark results identify weaknesses of the die face design.

MSTEP and QuickSetup

In this module, a one-step solution using MSTEP is included to perform a quick evaluation of part formability. FS includes a QuickSetup for standard single-stage draw die and springback simulations.

Autosetup and Multiple-Stage Simulations

AutoSetup is available for complicated multiple-stage forming setups for all formability applications of various die systems. The AutoSetup interface visually guides the user through the setup process. All travel curves are automatically generated and multiple-stations can be setup seamlessly.

Hydroforming Capabilities

FS can support tube bending, tube hydroforming and sheet hydroforming.

Springback Compensation Process (SCP)

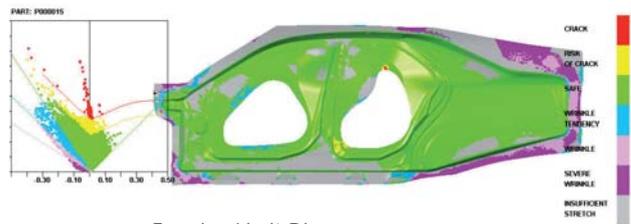
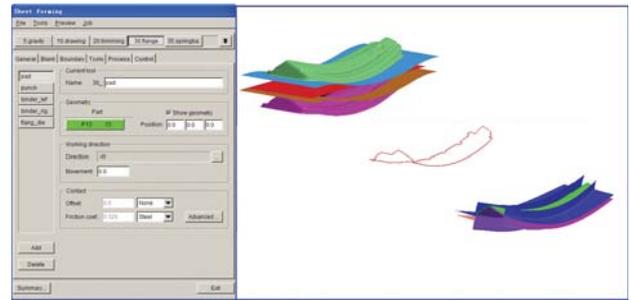
Using the DYNAFORM SCP, the user can determine and simulate the amount of springback compensation; simply define the selected tool to be compensated in SCP.

Special Forming Processes

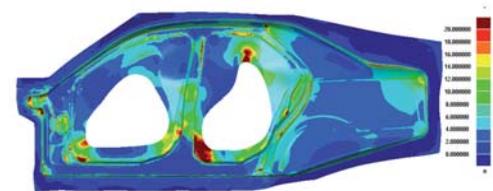
FS can support stretch forming, thermal forming, roll forming and super plastic forming for specialized manufacturing processes.

Material Library

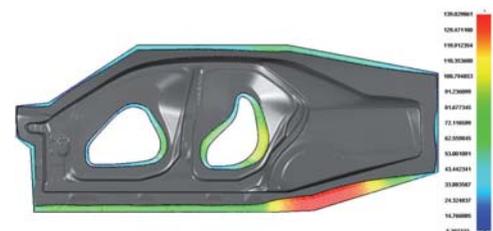
To maintain accuracy, the bundled material library contains a large selection of standard material types and users can also customize the library to meet specific needs such as: Gravity Load, Draw Die (Crash Form, Inverted Draw (Single Action), Toggle Draw (Double Action)), Trimming, Flanging, Re-strike, Springback and Springback Compensation, Tube Bending & Hydroforming



Forming Limit Diagram



Thinning Map



Material Inflow



Circular Grid

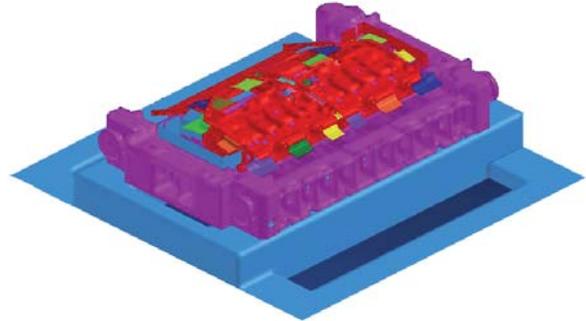


Light Strip Visualization

The Finite Element Analysis approach to die system design is an efficient way to predict and resolve many stamping related concerns within the die production line. Die System Analysis (DSA) simulations streamline die system design through the analysis of scrap shedding/removal, structural integrity and sheet metal transferring/handling. DSA's process guidance approach allows engineers to use simple graphic interfaces to execute complicated preparation and simulation processes.

Scrap Shedding and Removal (SHR)

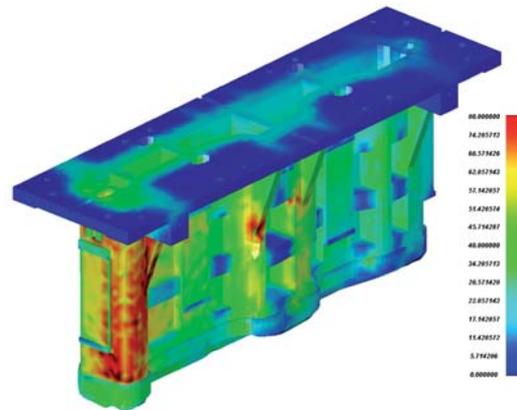
The number one cause of stamping line shutdown is the failure of scrap to exit the workstation. This problem can be predicted and corrected in the trim die design stage to avoid troubleshooting in the stamping plant. SHR streamlines model generation for scrap, trim dies, chutes and trim steel. Trimming operations and shedding simulations can be easily setup in the scrap shedding graphic interface.



Scrap Shedding & Removal

Die Structural Integrity (DSI)

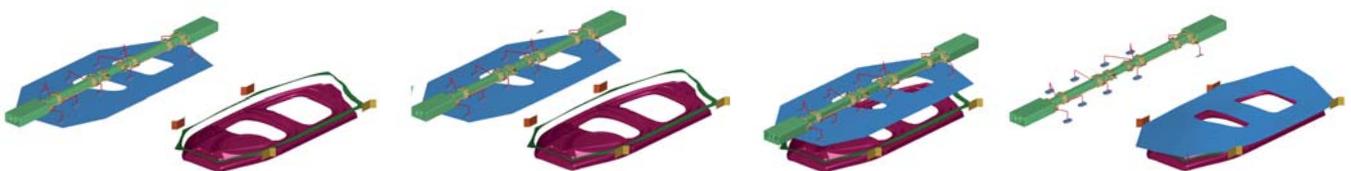
DSI simulates operational loads to analyze the design integrity of the die. DSI can generate FEA models of the die structure, define operational/stamping loads and evaluate the die structure strength and durability by using implicit and explicit solutions.



Die Structural Integrity

Sheet Metal Transferring and Handling (SMTH)

SMTH simulates the transfer of metal as it progresses through the manufacturing process. It simulates the transfer of the work-piece to the initial die station, movement between stations, pick-up of the finished part and placement on the shipping rack. Part deformation generated in the simulation is used to predict interference between the work-piece and tools. The stress/strain results can be used to prevent damage during transportation, as well as loading and unloading operations.



Sheet Metal Transferring/Handling (SMTH)



DYNAmore GmbH — Gesellschaft für FEM Ingenieurdienstleistungen

Headquarters

DYNAmore GmbH
Industriestr. 2
70565 Stuttgart, Germany
Tel. +49 (0) 7 11 - 45 96 00 - 0
Fax +49 (0) 7 11 - 45 96 00 - 29
E-Mail: info@dynamore.de

Office North

DYNAmore GmbH
Im Balken 1
29364 Langlingen, Germany
Tel. +49 (0) 50 82 - 9 14 00 - 51
Fax +49 (0) 50 82 - 9 14 00 - 49

Office Ingolstadt

DYNAmore GmbH
Donaustr. 7
85049 Ingolstadt, Germany
Tel. +49 (0) 8 41 - 12 60 48 - 34
Fax +49 (0) 8 41 - 12 60 48 - 38

Office Dresden

DYNAmore GmbH
George-Bähr-Straße 20
01069 Dresden, Germany
Tel. +49 (0) 3 51 - 4 51 95 54
Fax +49 (0) 3 51 - 4 51 95 61

Offices on-site

Daimler AG, Sindelfingen
Tel. +49 (0) 70 31 - 81 31 91

Daimler AG, Untertürkheim
Tel. +49 (0) 7 11 - 45 96 00 - 20