

OpenForm



**A New Intuitive Graphical User Interface for Industrial
Forming Simulation**

GNS mbH

Overview



GNS in brief

Software

Openform: Targets of development

Openform: Moduls

Conclusion

GNS in brief



Founded

1994

Fields of business

Engineering services in fields of FEA
Development and support for FEA software

Employees

Around 80 engineers, mathematicians,
software developers

Headquarters

Braunschweig

Subsidiaries

Ingolstadt, Flörsheim, Sindelfingen

Customers

Automotive industry, aerospace,
consum-goods industry

Software



Animator4

General postprocessor for finite element simulations in fields of crash, statics, dynamics, NVH, durability

Generator2

Preprocessor for the positioning of dummies, impactors for passenger and pedestrian protection,

INDEED

High-end finite element software package for metal forming (deep drawing, hydroforming, roll forming, tube bending, etc.)

OpenForm

Software package for pre- and postprocessing of forming simulation

OpenForm

A New Intuitive Graphical User Interface for Industrial Forming Simulation

Targets of development

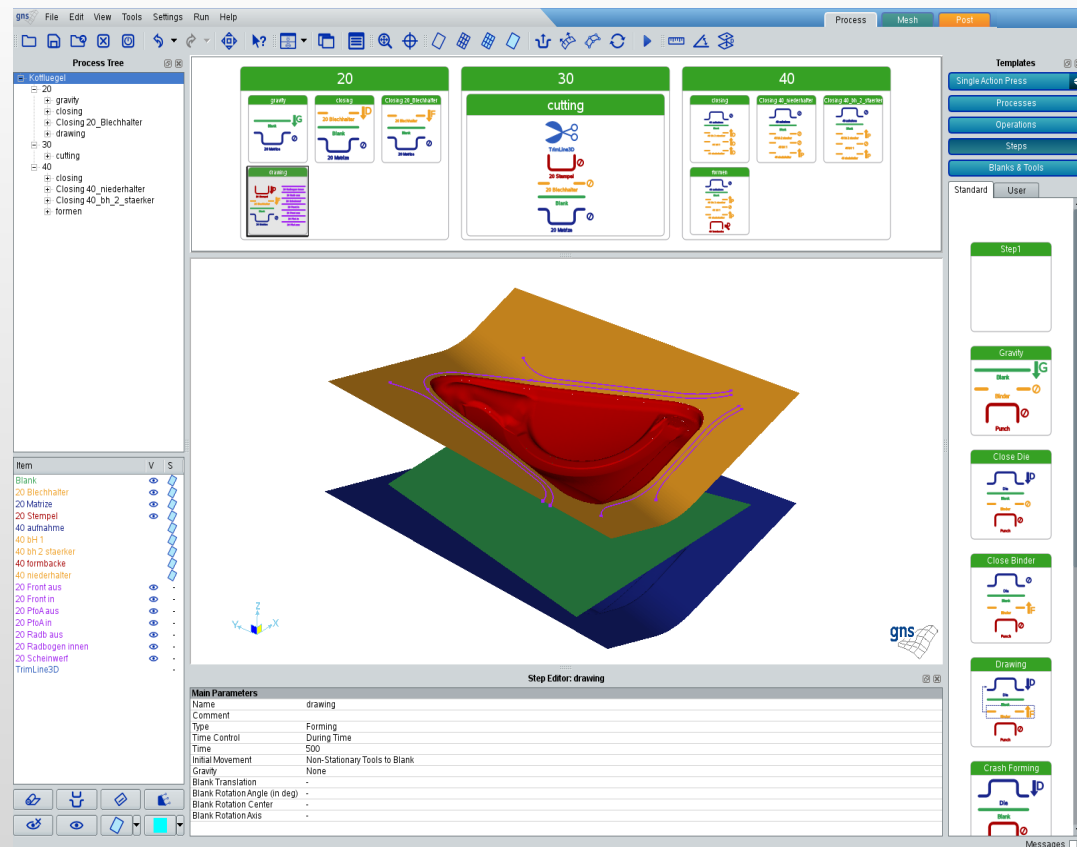
- Die designer should be able to set up a FE analysis
- Automation and standardization of the forming simulation
- Being independent of solver software
- Simple & intuitive GUI
- 'Open' and flexible software concept, for easy extension

OpenForm

A New Intuitive Graphical User Interface for Industrial Forming Simulation

Modules

- ProcessGenerator
- MeshGenerator
- PostProcessor
- MaterialViewer
- SimulationMonitor



OpenForm: ProcessGenerator

Design concepts

- Method plan oriented structure of the forming process
- Symbolic process definition & schematic diagram of the defined processes
- Strict separation between physical and numerical process description
- Templates for processes, operations, process steps, control parameters
Both predefined and user-defined
- Process definition independent of solver software
Input decks could be generated for each solver by implementing the appropriate interfaces

OpenForm: ProcessGenerator

Features

- Simple & intuitive process building by drag & drop
- Setting up multiple processes
- Definition of default Solver Control parameters
- Definition of Solver Control parameters per process step
- Kinematic Check
- RestartGenerator
- MaterialSelector/Viewer
- Context sensitive visualization of tools, blanks and draw beads
- Undo functionality
- Create INDEED Input
- Create LS-DYNA – Input (*)

(*) planned

OpenForm: ProcessGenerator



The screenshot displays the OpenForm software interface. At the top, there is a menu bar (File, Edit, View, Tools, Settings, Run, Help) and a toolbar with various icons. Below the menu bar is a 'Process Tree' panel on the left, showing a hierarchical view of the process steps: 20 (gravity, closing, Closing 20_Blechhalter, drawing), 30 (cutting), and 40 (closing, Closing 40_niederhalter, Closing 40_bh_2_staerker, formen). The main workspace shows a 3D visualization of a forming process, with a red die and a blue punch forming a part on a green blank. The 'Step Editor: drawing' panel at the bottom provides 'Main Parameters' for the current step:

Name	Value
Name	drawing
Comment	
Type	Forming
Time Control	During Time
Time	500
Initial Movement	Non-Stationary Tools to Blank
Gravity	None
Blank Translation	-
Blank Rotation Angle (in deg)	-
Blank Rotation Center	-
Blank Rotation Axis	-

On the right side, there is a 'Templates' panel with buttons for 'Single Action Press', 'Processes', 'Operations', 'Steps', and 'Blanks & Tools'. Below this, there is a list of templates including 'Step1', 'Gravity', 'Close Die', 'Close Binder', 'Drawing', and 'Crash Forming'. The 'Gravity' template shows a diagram of a blank being formed by a punch and die.

OpenForm: MeshGenerator

Features

- Automatic meshing of tools
- Offsets of tool meshes
- Automatic meshing of blanks, using different element types, based on *CAD faces CAD curves, polygons, circles, quads*
Remeshing of existing meshes
- Automatic fixing of mesh imperfections
- Integrated functionalities for checking and fixing CAD areas and FE meshes
- Large number of geometry interfaces:
IGES, VDAFS, STL, Nastran, INDEED
- Undo feature

OpenForm: MeshGenerator



The screenshot shows the gns MeshGenerator software interface. The main window displays a 3D mesh of a rectangular tray with a central depression, rendered in blue. The interface includes a menu bar (File, Edit, View, Tools, Settings, Run, Help) and a toolbar with various icons. On the left, there is a 'Geometry Data' tree showing a list of items including '20_Blechhalter', '20_Front_aus', '20_Front_in', '20_Matrize', '20_PfoA_aus', '20_PfoA_in', '20_Radb_aus', '20_Radbogen_innen', '20_Scheinwerf', '40_aufnahme', '40_bh_1', '40_bh_2_staecker', '40_formbacke', '40_niederhalter', 'Blank', and 'TrimLine3D'. Below this is an 'Item' list with checkboxes for each item. The right-hand side features an 'Assign and Modify' panel with tabs for 'Assign' and 'Modify'. The 'Assign' tab is active, showing 'Setting 20 Matrize geometry' and 'Main Tasks' (Add Mesh, From CAD Faces). Below this are 'Load New Faces' and 'Existing Faces' buttons. A 'Selector' section includes 'All', 'Reset', and 'Invert' buttons, along with 'Options' (Collect selected Items) and 'Method of Selection' (Direct). The 'Mesh Settings' section is set to 'INDEED' and includes parameters for Type (Tria), Length (30), Min Length (0.1), Max Length (50), and Max Arc Gap (0.05). A 'Replace current Mesh' checkbox is checked. At the bottom of the panel are 'Mesh Selection' and 'Check Mesh' buttons.

This panel shows the 'Mesh Failure Settings' for 11 rounds. The settings include:

- Undercut Max Angle (deg): 91
- Min Angle (deg): 0.4
- Max Angle (deg): 179
- Neighboring Normals (deg): 40
- Min Area: 0.01
- Check for doubled neighbors

 Below the settings is a table with columns 'Id', 'What', and 'Value':

Id	What	Value
13567	Doubled	
13582	Doubled	
18183	Doubled	
21437	Doubled	
32119	MinAng	0.117034
10993	MinAng	0.117034
33869	MinAng	0.128204
30788	MinAng	0.22985
15357	MinAng	0.304546
27732	MinAng	0.372729
3416	MinAng	0.39017

 At the bottom of the panel are buttons for 'Delete', 'Flip', 'Merge', 'SelectAll', 'Repair', and 'Auto Repair'.

OpenForm: PostProcessor

In general

- Forming specific post processing
- Fast reading of post data (ASCII & BINARY)
- Selection of single increments or post variables
- Visualization of adaptively refined meshes
- Good graphics performance for large models
- Simple and intuitive user interface
- Automated reporting tool available (*)

(*) based on Animator4

OpenForm: PostProcessor

Data formats

- INDEED result files
- LS-DYNA result files
- AutoForm result files (ASCII)
- AutoGrid data

OpenForm: PostProcessor

Visualization

- Scalar and vector variables:
thinning, thickness, strains, stresses, reaction and contact forces, ...
- Formability
- Skid / Scratch Lines
- Springback
- Animation
Separately for individual process steps or operations
- Tools and their movement as a function of process step
Automatically display only the currently active tool, draw beads, ...
- Dynamic Section
- Reference configuration
- Various display modes for blanks and tools:
Boundary, Wire, Shaded, Shaded Smooth

OpenForm: PostProcessor

Graphical Presentations

- FLD, Live FLD
- Tool forces and displacements
- Blank forces
- Section Plots: *post variable along a cutting plane*
- History Plots: *time history plots of selected nodes on the blank*
- Simulation Plots: *number of nodes, elements, increments, ...*

OpenForm: PostProcessor



The screenshot displays the OpenForm PostProcessor software interface. The main window shows a 3D model of a wing structure with a color-coded formability heatmap. A legend at the top indicates the formability levels: Inadequate Stretch (dark blue), Wrinkling (light blue), Wrinkling Tendency (green), Safe (yellow), Risk of Cracks (orange), Severe Thinning (red), and Cracks (dark red). The 3D model shows the wing with various regions colored according to these levels, indicating areas of concern like wrinkling and cracking.

On the left, the Process Tree lists the simulation steps: 20 (GRAVITY, CLOSING, CLOSING_20_BLECHHA..., DRAWING), 30 (CUTTING), and 40 (CLOSING, CLOSING_40_NIEDERHA..., CLOSING_40_BH_2_STA..., FORMEN). Below the Process Tree is the Item list, which includes various components like BLANK, 20_BLECHHALTER, 20_MATRIZE, 20_STEMPEL, 40_AUFNAHME, 40_BH_1, 40_BH_2_STAERKER, 40_FORMBACKE, 40_NIEDERHALTER, 20_FRONT_AUS, 20_FRONT_IN, 20_PFOA_AUS, 20_PFOA_IN, 20_RADBOGEN_INNEN, 20_RADB_AUS, 20_SCHEINWERF, and TRIMLINE3D.

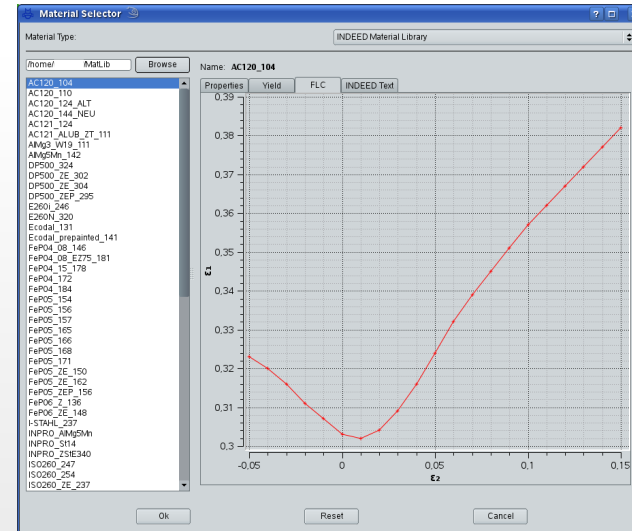
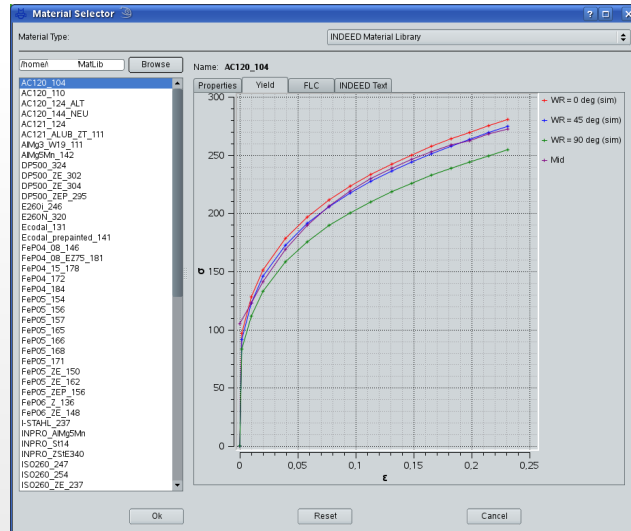
At the bottom left, a small 3D coordinate system shows the model's orientation. Below it, the text reads: kotfluegel_Typ10: 100% 1206.11, 40: 100%, FORMEN: 100%.

In the center, a window titled "Formability" is open, showing a 2D plot of the formability results. The plot has a grid and axes ranging from -1.4 to 1.4. The data points are colored according to the formability legend, showing a distribution of values across the wing's cross-section. The window includes a "Fit to Window" button and an "Auto Scale" checkbox. The X Range is set to -1.40 to 1.40, and the Y Range is set to -0.10 to 1.00.

On the right side, the Post Data panel is visible, showing options for Enabled Variables (Scalar, Vector), Show on (Element), and various plot settings for Thickness, Strain, Stress, Distance to Reference, and External Comparison. The Layer selection is set to 1.

At the bottom right, there are buttons for XY Plots: Tools, Blanks, Simulation, History, and Cross Section. A Messages box is located at the very bottom right.

OpenForm: MaterialViewer



Elastic Properties	
Young's Modulus	72000
Poisson's Ratio	0.3

Plastic Properties				
Direction	R-Values			Biaxial
	0°	45°	90°	
Value	0.677	0.549	0.682	

Yield Stresses				
Direction	0°	45°	90°	Biaxial
	Value	114.83	100.29	100.66

```

Material Type: INDEED Material Library
Name: AC120_104
Properties | Yield | FLC | INDEED Text
$ LITTEY ANMERKUNG = 30 11.99
$
$ -----
VERSTOFFFLASSE -I-
BEGINN SIMULATION
LINEAR ELASTISCHE EIGENSCHAFTEN / ISOTROP
$ EMODDL POISSON
72000 0. 0. 3.
-----
HILL48-MODELL MIT KONSTANTER KINEMATISCHER VERFESTIGUNG [1]
$ EINGANGSDATEN FUER ABGLEICH AUS: AC120_104_c.ab1
$ STUERGWERTE : MATRIKIALMODELL 1
$ OPTIMIERTE : FLIESSKURVE, R-WERT, ANPASSUNG-BIS-EFFEKT
$ -----
$ SA1 SA2 SA3 SDRD4 VALWR
$ ALPHA1 ALPHA2 SB11 SB22 SB12 SB512
4.790 -3.020 1.000 1.097000 -0.400000 1.354000
-----
HILL48-MODELL MIT ISOTROPER VERFESTIGUNG [7]
R-WERT
$ WLNK R00 R45 R90
0.0000 0.6770 0.5490 0.6820
MITTLERE FLIESSKURVE
$ ANZAHL DER WERT-PAARE
35
$ LOGARITHMISCHE (HINKYSISCHE) VERKERRUNG : CAUCHY SPANNUNG
0.00000 105.2600
0.00975 122.7233
0.02005 141.2700
0.03232 163.0457
0.05813 189.6400
0.07701 206.1333
0.09603 219.0300
    
```

OpenForm: SimulationMonitor



Conclusion

- Solver-independent pre- and postprocessor specifically designed for sheet metal forming
- Easy access to high end forming simulation software for die designers
- Open concept allows simple switching of different solvers
- Firm separation of physical and numerical process
- Easy way of defining templates for processes and parameter settings

**Thank you for your
attention,
questions can be answered
here or at our booth in the
exhibition**