Main development areas

◆ Improved usability (easy to use)
  ➢ Simplified project creation
  ➢ Improved post processing features & options
  ➢ Safe process creation & modelling (improved model check, interactive error check during process creation)

◆ Improved result quality

◆ More robustness

◆ Increased performance
General improvements (FE/FV)

Preprocessing/Process setup
New application wizard (AFS)

- New wizard concept of application choice (AFS technology)

  - Overview of available application modules

  ![Application module]

  - 3 standard application modules
  - 6 additional application modules

  - Opens info sheet
  - Opens tutorials
  - Opens Demos&Examples
Why?

- Complete overview of all applications available within Simufact.forming (process chain)
- Appropriate and casewise special simulation parameters adjusted to selected application & process type
- Allows customizing of user-defined simulation parameters (create your own standard settings)
- Adjustment of parameters as default settings (easy to use)
  - Automatic time step control
  - Automatic choice of appropriate friction laws
  - Automatic setup of convergence
  - Automatic solver selection
  - Automatic choice of mesher type and others
New application wizard (AFS)

Get information about the specific application module (info sheet, tutorial, Demos & Examples)

Several process types within selected application module (process chain)

Edit comments with user & time stamp that will be saved to the process and process report automatically

Brief description of the selected feature (→ hold Ctrl key to lock)
Customizing of Simufact.forming

- Simple and flexible adaptation of user-specific simulation parameters like:
  - Number of used tools
  - Ambient temperature
  - Solver type
  - Criteria for convergence
  - And more

Presettings are stored in *.ini files within installation folder

Refer to installation path:
- ..\simufact\forming\12.0\sfForming\settings
New application wizard (AFS)

- Concise and user-friendly visualization of licences to be activated for selected application modules
New info sheets for the description of the different application modules

Each process type uses a special set of internal settings (like mesher, solver or contact options) that are optimized for the specific process conditions.

Available process types are:

**Forging (General)**
Use Forging (General) to model impression die forging operation with and without flash.

**Upsetting**
Upsetting uses flat or nearly flat tools and is usually a pre-forming operation to reduce the workpiece’s height or for descaling.

**Bending**
Bending typically applies forces on small areas so that the curvature of the workpiece is changed (often only locally).

**Extrusion**
Select Extrusion for any type: forward, backward/reverse, combined and impact extrusion.

**Rolling**
Rolling is to be used for bulk forming processes with rotating tools. Typical applications are reducer rolling or cross wedge rolling.

**Cooling**
Use Cooling to simulate the dimensional change of the workpiece due to decreasing temperature or to take into account the handling time between two process steps. At the end of the cooling step residual stresses and warpage can be analyzed.

**Heating**
Use Heating for any heating operation to take into account the dimensional change.

**Cutting**
Cutting is to be used for any piercing, blanking, trimming and shearing operation.

**Die load**
Die load provides the functionality to determine the stress state in tools by transferring process loads from a previous forming simulation. It is also used to investigate the prestressing conditions in forging dies due to press-fit.
Now implemented: CADfix version 9.0 SP1

(https://www.transcendata.com/support/cadfix/index.htm)

Native Interfaces
- CATIA V5/R23
- CATIA V4/ 4.1.X, 4.2.X
- Pro/Engineer Wildfire 5 and Credo V1.0
- SolidWorks 98 to 2013
- Siemens (Unigraphics) NX1 to NX8.5
- Inventor up to 2013

Neutral Interfaces
- ACIS R23
- IGES 5.3
- STEP AP203 & AP214
- Parasolid V25
- VDASF 2.0
- STL

STEP import now available for all users (recommended as new default interface)
- Automatic determination and visualization of „facet sags“ dependent on part dimensions (enveloping space)
  - CAD import: automatic „facet sag“ (minimum number of facets)
  - CAD preview: automatic / manual „facet sag“ (minimum number of facets / quality facets)

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CAD import

CAD preview (quality facets)
Improved geometry approximation with quality facets with reduced number of elements (expansion factor)

Use the expansion option to reduce number of facets. A higher value will merge more triangles on plane surfaces.

200 000 elements
Version 11.0

45 000 elements
Version 12.0
Improved CAD import

- Display CAD import error messages

- Previous user settings can be saved and restored to default if needed

- Display used parameters after the import
Redesigned + improved initial meshing

- More modern display technology
- Allows comparison of original geometry with created mesh
- Mesher log window stays open in case of errors
Redesigned + improved initial meshing

- Refinement boxes can be defined intuitively using the mouse.
- The definition and display of refinement boxes for the Ringmesher has been greatly improved.
You can select the origin of the mesh in multi-stage projects:

- Create a new mesh
- Transfer the result mesh of the previous process
- Use an externally generated mesh attached to the geometry
- Load a user-defined mesh from a file

You can see the origin of the mesh in the process tree:

- A mesh created manually:
- A mesh transferred from the result of the previous process:
Simplify the friction definition for steel by adding an automatic friction mode → the GUI chooses appropriate friction settings depending on temperature, lubrication and material

*(applicable for „General steel“ material only – other material groups will follow)*
Support the definition of all friction parameters through temperature-dependent tables
Improved geometry properties dialog

- More modern display technology
- Display exact bounding box coordinates
All „modify geometry“ dialogs have been improved:

- More modern display technology
- Compare original geometry and result in the same view
- Improved design
- Compare facets / volume of original and result geometry
- The 2D cut preview can be rotated and zoomed now
- → easier to detect mistakes in the process setup
Facilitated insertion of dies

The insertion of dies into the process has been facilitated:

- More logical menu structure

You can set the type of the dies

![Image of the software interface showing the selection of die types and settings.](image.png)
Store geometries in the library

- Save your geometries to the library:

...and load them into any project:
The press definition has been greatly improved:

- Supports the Simufact help system (brief description)
- Improved plot
- Enter comments with time stamp
Improved definition of force-controlled hydraulic presses
Improved table press definition:

- Enter table values directly into the table
- Move table rows up / down
Support „automatic“ mode for emissivity for heat radiation to the environment:

→ The program will choose appropriate parameters for the simulation automatically.
Redesign of rotation dialog

- More intuitive use of the rotation dialog
- Control direction of rotation via input button
- Possibility of multiple rotations of components
- Rotation about defined rotation axes (→ rolling)
- Rotation about specific axes of rotation (→ define points)
Define symmetry/constraint planes separately

- Split symmetry / constraint planes dialog into two independent dialogs

- Color back side of symmetry planes differently → easier to distinguish between front and back
Redesign of forming control

- Improved the structure of the „forming control“ dialog
- Clear display of termination criteria (contact, force)
- Important (often used) parameter settings are displayed clearly on the first input dialog (e.g. parallel computing [DDM])
Show error message if the material is not defined for the workpiece temperature

Show ambient / furnace temperature in process tree
Miscellaneous usability improvements (2)

- Zoom with the mouse wheel
- Allow assigning the workpiece temperature by dropping it on the process
- Offer more predefined colors for components

- Prevent automatic renaming of components by pressing the Ctrl key
- Show progress while opening projects with a lot of results

- Add option „copy and replace“ to facilitate exchanging items in the process tree with slightly modified variations
Save manual DAT file modifications in a „patch“
Apply the same modifications when you calculate the process again
Simulate variations with the same modifications
Show all DAT file modifications in the process report
Import model from result: The selection of the result increment can also be based on stroke, time, crank angle or solver increment now.
Store project-related files

- Project-specific and / or user-specific data can be saved now with the project, i.e.:
  - Native CAD data
  - CAD drawings
  - E-mail traffic
  - Notes…etc.
General improvements

- Support 3D → 2D stage transitions
- Transfer rotation axis and local coordinate system when remeshing a surface
- Allows import of result data from:
  - Other Simufact.forming 12.0 projects
  - Simufact.welding 4.0 projects
  - Simufact.formingGP models
Clear separation between standard database (material data provided with installation) and user-specific database (user-defined materials)

- User-specific database will be created automatically within user directory
- Common use of standard and user-defined data within one user group / application group (by means of mapped network drives)
- User-specific database will not be deleted during uninstallation / new installation
Material

Definition of user directory
Definition of common database by means of mapped network drives (user group)

Definition of unit system is for visualization purposes only – it will have no impact on the unit system used for the calculation!
Improved definition of flow curve characteristics

Validity range (temperature, strain, strain rate) for all analytical approaches now implemented for both FE and FV as well

Input dialog for validity range of parameters

You can switch to the „old“ settings here (not recommended)
Visualization of analytical flow curve models

By means of a "slider" you can check dependencies of flow stress on temperature and strain rate. Changes are displayed interactively in the diagram.
- New: Hockett-Sherby material model now implemented
- Main application for sheet forming
- Validity ranges: temperature 20°C - 200°C, strain 0-2 (editable)
- Strain rate is not considered

\[ \sigma_f = b - (b - a) \cdot e^{-m \cdot \varepsilon_p} \]

Parameter a: yield strength
Parameter b: saturation stress
◆ More comfortable definition of customer-specific material data (user-defined)
◆ Allows export of existing data into *.csv format

Excerpt of a saved *.csv file
General improvements (FE)

Preprocessing/Process setup
General improvements (FE)

- Support „release dies“ and „release workpiece“ substages in combination with table press
- Support segment-to-segment contact calculation → improved deformable-deformable contact (not supported with DDM yet)
- Support time-dependent tables for generic springs
- Add option „stabilize only“ for generic springs → stabilize freely rotating dies
- Support output of T16 file at the end of each loadcase
- Improve step size control
  - Support automatic step control for table presses for all step size control modes
  - Support displacement change step control for hammer and screw press
Usability

◆ Redesign and improve the substage dialog
  ◆ Improve definition of trimming loadcase
  ◆ Add new cooling stage
  ◆ Allow the release of fixed tools in user-defined order
  ◆ Improve the release of moving tools in user-defined order

◆ Improve contact table dialog and general behavior
◆ Add automatic solver option based on element type
◆ Display all increment data for selecting die load result steps instead of increment only
◆ When using a deformable die, add a contact table automatically
General improvements (FE)

- Display all increment data for selecting die load result steps instead of increment only
General improvements (FE)

Material

- Support Chaboche analytical flow curve model
- Support grain size calculations for Matilda material with DDM
- Improve grain size calculations in multistage simulations
- Support Johnson-Cook damage model
- Support damage model based on forming limit diagram
- Support rigid-plastic material approach
- Display latent heat for JMatPro materials
- Improve visualization of TTT / CCT curves
Kinematics

- Add kinematics press automatically during process creation
- Support one or two manipulators for radial forging in z direction
- Support automatic step size control for RAW and MERW
- Support Johnson-Cook damage model
- Support remeshing based on critical mesh part for MERW
- Improve the user-defined kinematics dialog
General improvements (FE)

Meshing

- Allow import of meshes directly from FEM, ARC or BDF files, create the geometry automatically from the mesh
- Support direct transfer of previous mesh in multistage simulations when possible
- Support refinement boxes for initial meshing with Advancing Front Quad mesher
- Support number of splittings in split remesh criteria for Advancing Front Quad mesher
- Support segmented cylindrical refinement boxes in all orientations for Sheetmesher
- Support refinement level > 1 in the Sheetmesher
Refinement boxes for the Advancing Front Quad mesher are supported in initial meshing now:

- The mesh is refined at the outline.
- For inside refinement use the QuadTree mesher.
The Sheetmesher supports refinement levels greater than 1 for refinement boxes now:
Meshing

- Add option to force mesher output even if the result mesh is corrupt
- Use improved Patran mesher for initial meshing
- Support ring meshing for 90- and 180-degree parts
- Visualize the critical mesh part for the Ringmesher
- Check initial mesh for inside-out elements before starting the simulation
R&D

- Bundle all user subroutine settings at one place → new dialog „user-defined“ in forming control
- Add edit button for user subroutines
- Improve usage of user-defined post variables
General improvements (FV)

Preprocessing/Process setup
General improvements (FV)

Usability

◆ Support a cooling substage after forming → simplified definition of workpiece cooling during the holding time in the fixed die
◆ Move „adaptive element size“ settings (formerly „solver optimize“) to the element size settings → more logical structure
◆ Improve usage of user-defined post variables

◆ Support dieload analysis for FV multiblow simulations
◆ Set and display FV volume mesh size directly in the initial meshing dialog
Surface meshing and FV meshing in one dialog
General improvements (FE/FV)

Postprocessing/result evaluation
General improvements (FE/FV)

◆ New simulation toolbar displays the current status
◆ Some examples of status information:
  ◆ Job is finished based on stroke (predefined stroke is reached)
  ◆ Job is finished based on energy (given energy is consumed)
  ◆ Job is finished based on maximum force (predefined force limit is reached)
◆ Simulation progress can be displayed as current %, stroke, time or increment
New result management

◆ New features are:

➢ Direct import of solver result files (*.ARC) into GUI (performance)
➢ Conversion into *.SFR files unnecessary now (not applicable)
➢ GUI is not blocked anymore while importing results (→ better performance of preprocessing)
➢ Increased speed when loading results for animation purposes
➢ New „refresh“ button in animation windows. You need to open an animation window only once. New results can be read on demand.
➢ New data management for results – results are saved for each increment in separate folders
➢ Always select the last available result step by default
Customized result values

- Create additional results
  - User can define his "own" result values by means of mathematical functions (calculator functions)
    - User-defined result values will be stored globally and can be used for all further work
    - Restart of analysis is unnecessary

![Image of result value definition interface]

![Image of result value menu with Absolute Velocity selected]

![Image of meshed model with color scheme: Min. 0.000, Max. 975.308, and Absolute Velocity 59.09% (forming) highlighted]
Customized result values

- New standard scalar result: „accumulated plastic strain“ (total degree of deformation – total strain) now implemented
- Result values (animation / plot) can now be displayed dependent on crank angle (if crank presses are used)
Improved history diagram

- Better performance now when comparing different processes (2D/3D, FE/FV)
- Processes can be deleted from comparison view
- Display settings (i.e. units) are saved when selecting a new component
- Improved visualization of history diagrams for multiblow simulations
- Allows result values to be plotted over crank angle if crank presses are used
- Time, stroke, distance to BDC, crank angle can also be assigned to y-axis
Usability

- Add new option also to synchronize the window sizes when synchronizing views
- Accelerate result animations with view mode „outline“
- Add new color legends
Improvements (FE)

Postprocessing/result evaluation
Improvements (FE)

- Improve particle tracking
  - Improve usage for multiple dies
  - Support nodal result variables
  - Support particle tracking with die wear, normal stress and friction stress results

- Support forming limit parameter and FLP zones → predict material failure for sheet forming
- Also show near contact
- Show „contact“, „no contact“, „near contact“ instead of 0, 0.5, 1
You can add result images to the process report at increments defined by the solver:

- The solver marks especially interesting intermediate results in a special file
- The GUI adds result images for those „key moments“ to the process report
- The „key moments“ file can also be defined by the user
Usability

- Improve visualization of sheet meshing results
- Visualize near-contact results
- Improve the result display of die wear, contact stresses and sliding velocity for rigid bodies with heat transfer
- Show used matrix solver in the process report
Improvements (FV)

Postprocessing/result evaluation
Improvements (FV)

- Improve output of simulation time (wall time) for multiblow simulations
- Preserve run directory contents for all blows / cooling steps in FV multiblow which facilitates advanced investigations of intermediate results
Improvements (FE)

Result accuracy/calculation speed
Improvements (FE)

- Support direct mesh transfer in 2D-2D stage transitions without remapping
- Improve the management of edges in hexahedral meshes
- Improve stability of Sheetmesher by keeping track of top / bottom side
- Improve stability of approach and release substages
- Support advanced time stepping for table press → make sure that all important points of the table press definition are included in the simulation
- Enhance accuracy of near-surface mapping
- Improve mapping to Tet-157 elements
- Improve stability of hexahedral meshers
Improvements (FE)

- Support „relax only“ for hexahedral meshes with refinement / coarsening
- Improve handling of hexahedral meshes with refinement / coarsening
- Improve step size control for rigid-plastic material
- Suppress adaptive refinement for contact with symmetry plane
- Compute initial time stepping based on total time, stroke and contact tolerance
- Improve friction calculation
- Improve thickness calculation, also support DDM
- Initialize initial density distribution exactly cylindrical
- Support the MUMPS matrix solver
Improvements (FE)

- Improve results of parabola approximation in optimization simulations
- Improve calculation of phase transformation based on TTT
- Improve calculation with DDM
- Improve license management for DDM simulations → DDM simulations reserve their own sets of licenses and are not delayed by other simulations anymore
- Compute initial time stepping based on total time, stroke and contact tolerance
- Improve trimming capabilities
Improvements (FV)

Result accuracy/calculation speed
Improvements (FV)

- Improve general accuracy of results in FV simulations
- Improve implementation of material models
- Support combined material model composed of different models
- Improve algorithm for time scaling calculation
- Accelerate initial time step through better time scaling when using time ramp up
- Accelerate result transfer between stages / blows and for restarts
- Support latest Simlab meshing technology
- Improve higher-order solver
- Improve force calculation
- Improve friction calculation
Redesign of FV meshing

- Improve surface meshing
  - Keep small folds
  - Faster
Improvements (FV)

- Improve damage calculation
- Improve stability of multiblow simulations
- Improve robustness of meshing
- Improve algorithm for time scaling calculation
- Improve trimming capabilities
General usability
General usability

Improvements related to the display / process preview / result view

◆ Accelerate display of huge models
◆ Redesign and improve measuring, e.g. support measuring radiuses and angles
◆ Support new option to display springs in the same colors as the dies they are attached to
◆ Improve contrast / default line width when displaying curves
◆ Support low screen resolutions, adapt sizes of large dialogs automatically
◆ Show icon of application module in the process tree
General usability

Miscellaneous improvements

◆ Replace old batch processing („queue tool“) with new application Simufact.monitor
  ◆ Improve stability of batch processing
  ◆ Improve overview and general handling of running / finished simulations
  ◆ Does not support FV multiblow simulations yet → launch sfForming/bin/StartQueue.exe manually in order to use the old queue tool for FV multiblow simulations

◆ Enhance stability of remote simulations with the file synchronizer

◆ Redesign and improve the global options dialog

◆ Improve process report
General usability

Miscellaneous improvements

◆ Improve memory management → projects can contain a lot of processes

◆ Add dialog that gives an overview of all INI files and allows to change the settings (for administrators)

◆ Support non-ASCII characters in comment fields → user comments may contain Japanese, Chinese, Russian or Polish characters

◆ Improve stage control: When a process is aborted with an error, continue with the next process if no results need to be transferred

◆ Hide all predefined tables when setting the inventory filter to „unused“
Miscellaneous improvements

- Write essential hardware / software info into log file → facilitate problem diagnosis
- Enhance command line batch mode capabilities for advanced batch processing
- Display more informative error message when opening broken Simufact.forming projects
Tutorials and online help
Tutorials and online help

- Improve the tutorials
- Improve the demos & examples
- Improve the integration of the tutorials and demos & examples into the GUI
- Add new concept for instant help („info sheets“)
Simufact.formingGP
◆ Support spring-controlled and load-controlled bodies with DDM
◆ Facilitate result transfer between Forming and FormingGP: Forming can import ARC results and FormingGP can import T16 files → units are converted automatically
◆ Add Forming color legends to FormingGP
◆ Provide adapted color legend „sfForming GP“ in Forming with color scheme of FormingGP
Thank you very much for your attention!

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