

# Blow molding

## B-SIM

B-SIM – software package for simulation of extrusion and injection blow molding.

B-SIM predicts the final wall thickness distribution based on the specified processing parameters ( pressure level, speed of tools, initial temperature and thickness profile etc.).

B-SIM predicts image distortion and pre-distortion for in mold decoration and shrink sleeve processes.



## COMPUTER SIMULATION OF BLOW MOLDING



World's leading company in FEA of thermoforming, blow molding, in mold decoration and "shrink sleeve" processes

# Computer simulation of blow molding

## B-SIM

### About Accuform

Accuform has been active in the FEA (Finite Elements Analysis) field of blow molding for more than ten years. Accuform developed B-SIM, blow molding simulation software. Accuform sells the software through a network of representatives. Accuform also provides support, service and consultations.

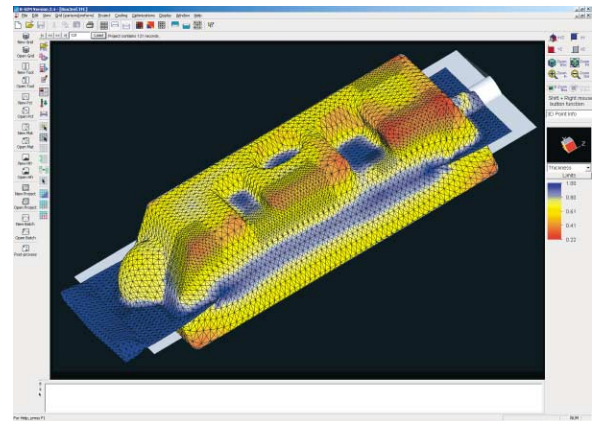
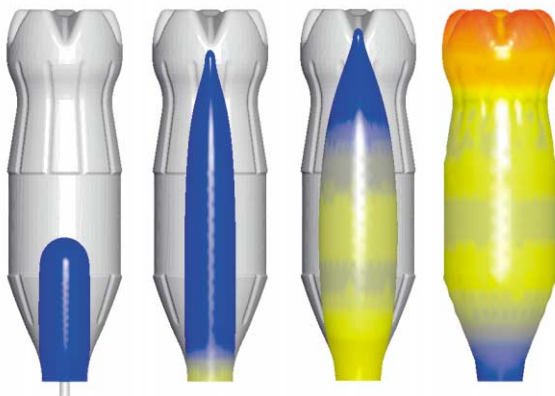
Accuform products are being used by many of the world's leading blow molding equipment manufactures as a part of their daily design procedures. Resin suppliers use our products for technical service assistance and as training tools. Processors around the world use our products and services for troubleshooting, equipment evaluation and the development of proprietary designs. Our commitment to product quality and our knowledgeable support staff have made Accuform products and services the choice of the blow molding industry.

### B-SIM Development

Accuform cooperates with German Dr. Reinold Hagen Foundation in development of up-to-date optimized software for extrusion blow molding. Thanks to this support we have knowledge of the practical problems and situations which have to be solved in the real process. The result is the new B-SIM program which takes into account the needs of processors from practical experience, using a friendly interface.

### Why Simulate a Blow Molding Process?

- Reduce the design time for your products
- No need to perform expensive trial-and-error procedures
- Select an optimum design from many possible alternatives
- Get optimum thickness distribution on final product via ideal thickness settings on the preform/parison
- Get optimum thickness distribution on final product via ideal temperature settings on the preform
- Design pre-distorted images for shrink sleeve process
- Analyze cooling process
- Analyze part shrinkage
- Calculate final part weight
- Use predicted thickness distribution for structural analysis
- Optimize parison extrusion process
- Optimize preform thickness profile



### B-SIM Features

- Simulates extrusion blow molding from parison
- Simulates extrusion of parison with advanced parison programming
- Multiple materials can be used
- Simulates stretch blow molding from preform
- Fully customizable initial thickness and temperature profile on preform
- Import of general preform geometries from ANSYS
- Time dependent deformation is described by viscoelastic K-BKZ model
- Three different damping functions for a better material data fit (strain hardening)
- WLF temperature dependency
- Material database containing PE, PP, PET, PC, PMMA, ...
- Imports general 3D molds from CAD packages. Supported formats: stereolithographic STL, DXF, Patran Neutral, VRML, HyperMesh ASCII
- All molds independently movable (up to 10 tools can be used in one simulation project)
- Time dependent parison sagging included
- Friction between stretched plastic material and plug
- Heat transfer between material/molds and material/air
- User-friendly setup of technological parameters
- Context sensitive help, tutorials and hands-on examples
- OpenGL used for 3D visualization, allowing dynamic image rotation, zooming and panning
- Interactive graphical user interface
- Easy, completely editable setup of B-SIM project for solver. Tight connection between initial project and result files
- Many typical blow molding problems solved and distributed as examples
- Automatic project report creation (HTML+VRML). The report appearance is fully customizable by an HTML template

## Material Behavior Description

- Data of frequently used polymers are available in the B-SIM material database
- Any material can be tested in cooperation with IKP Stuttgart, Germany or DatapointLabs, USA
- Measured stress/strain curves can be fitted using T-SIMFIT software package

## Solver

- Very fast iterative multithreaded solver gets use of parallel processing on PC with more than one processor
- Upper limit of sheet and molds elements is limited only by PC memory available
- Fast contact analysis
- Solving a set of blow molding problems in a batch mode. This enables automatic case study solution

## Postprocessing

- 3D color maps of thickness, temperature, stress, extension, 3D cuts
- Visualization of contacts between plastic material and tools
- Easy refinement of the grid in 3D areas of interest directly from the post-processing window
- Export of optimized preform thickness profile to STL
- Export results for structural analysis to Ansys, IGES, DXF, Cosmos/M, Patran, LS-Dyna files
- Output to Patran format enables structural analysis and calculation of cooling
- Interactive thickness/temperature/position information with a simple mouse click
- Export animation file to Microsoft Video Player format
- Critical venting areas analysis
- Cooling calculation
- Shrinkage prediction
- Part weight calculation
- Position tracking enables analysis of critical parts of the product

## Automatic Optimization Modules

Extrusion blow molding:

- Extrusion control optimization (AWT / PWT / SFDR parison programming)
- Parison initial thickness optimization

Injection / stretch blow molding:

- Preform initial thickness optimization
- Preform initial temperature optimization
- Preform geometry optimization (optimizes D/L ratio)

## Pre-distortion of Images – Option

- Prediction of printed image deformation
- Useful for in-mold decoration and shrink sleeve processes
- B-SIM is able to pre-distort images for printing them on the flat sheet, so that once molded the images appear true
- Image projection manager enables projection of multiple images using various projection methods (planar, cylindrical and spherical projection)
- 3D VRML models can be also used for image pre-distortion



## Customer Support

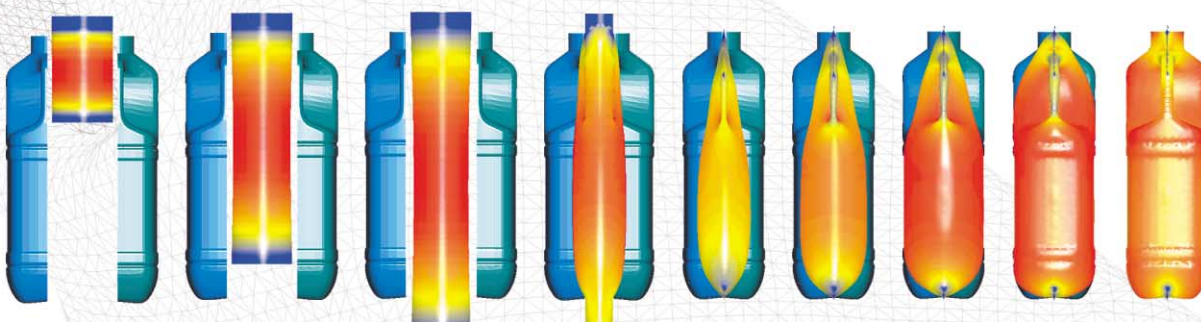
- Export of internal B-SIM files for easy data exchange via Internet. This facilitates fast customer support worldwide
- Support through Accuform representatives worldwide

## System Requirements

- PC with 512 MB RAM minimum
- Microsoft Windows 2000 or Windows XP Pro

## B-SIM Users

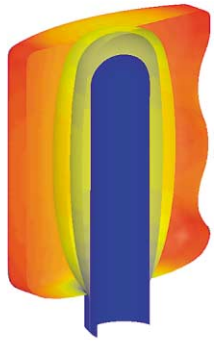
- B-SIM is used by industry leaders worldwide at TI Automotive, SIG group, Urola, PCM, SK Chemicals, COMEP France and many others





## B-SIM Automatic Optimization of Preform Thickness Profile

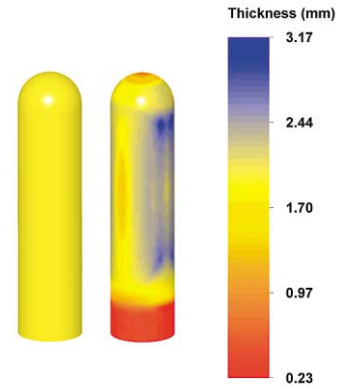
Simulation



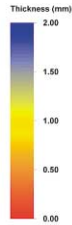
Tool in B-SIM



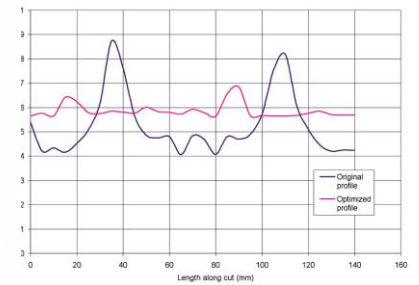
Initial preform profiles  
(original and optimized)



Final thickness profiles  
(original and optimized)

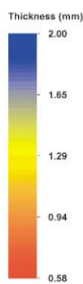


Final thickness profiles along 3D cut  
(original and optimized)

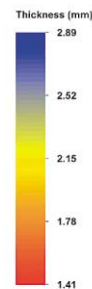
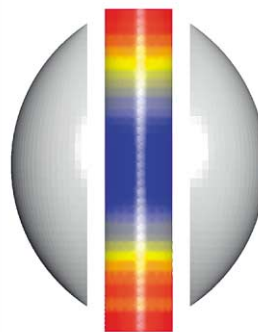


## B-SIM Automatic Optimization of Parison Extrusion

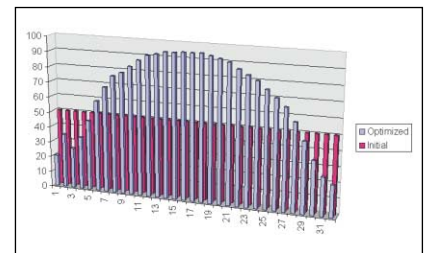
Final thickness profiles  
(original and optimized)



Optimized extruded parison



Optimized and original AWT  
(Axial Wall Thickness)  
control settings



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