

Altair® HyperXtrude®

Engineering the Polymer Extrusion Process

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Altair® HyperXtrude® is an engineering simulation environment for extrusion-die-design and production engineers to analyze material flow and heat transfer during extrusion to validate die designs. HyperXtrude enables extrusion companies to handle a higher mix of complex extrusion profiles and still shorten product development cycles, reduce their production costs and improve product quality.

Benefits

- **Minimize die design time and cost:** Robust, reliable and efficient computer simulation provides insight and direction before cutting dies and press set-up.
- **Design robust die assemblies:** Optimize die designs by accurately predicting tooling deflection and stresses due to extrusion loads to optimize die designs.
- **Increase productivity and reduce scrap:** Minimize scrap and extrusion defects and optimize process conditions.
- **Maintain acceptable cost structure:** Cost analysis module helps identify optimum process conditions and ideal press weight to be cost effective.
- **Improve product quality:** Optimize process conditions to products with proper strength properties.
- **Drastically reduce the overall product development cycle time**
- **Gain competitive advantage**

A Complete Solution

Die Design Engineers:

- Test and validate new die designs
- Determine correct land lengths
- Adjust mandrel and spider dimensions

Simulation Engineers:

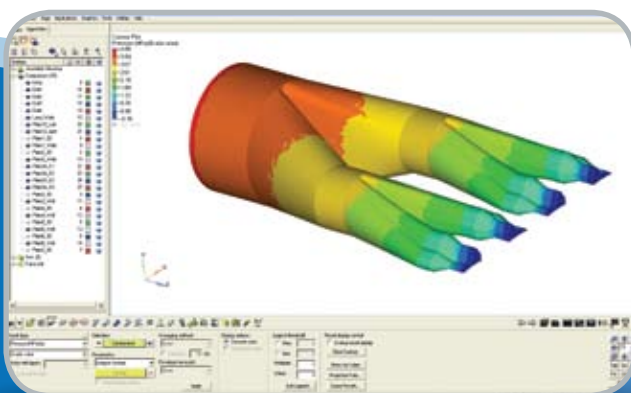
- Design proper tool support
- Predict tool wear and failure
- Troubleshoot problem dies
- Thermal management

Production Engineers:

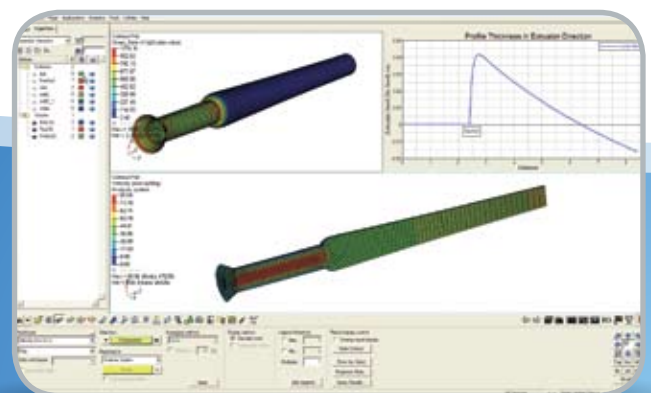
- Determine optimum process conditions
- Determine optimum cooling and calibration set-up
- Maximize recovery

Quality Engineers:

- Determine product quality
- Optimize surface quality and profile shape
- Calculate profile yield strength



Profile Extrusion Die



Velocity and Pressure Distribution in a Spiral Die

Capabilities

HyperXtrude is a CAE tool used for virtual testing, validation, correction, and optimization of extrusion process and die designs. Using HyperXtrude's broad capability set, engineers can identify design errors before they become costly problems.

Extrusion-Specific User Interface:

- Import die drawings in native CAD data format
- Process-flow-based extrusion wizard enables users to analyze dies in a few simple steps
- HyperXtrude Job Manager enables users to submit jobs on remote computers

Support for All Die Types:

- Solid, semi-hollow, and hollow profiles
- Multi-hole dies
- Film and sheet dies
- Spiral dies
- Co-extrusion

Predict Extrusion Defects:

- Die swell prediction
- Profile shape prediction
- Surface defects
- Track interface of different materials
- Predict weld lines

Thermal Management:

- Determine optimum melt temperature
- Coupled flow and thermal solvers

- Control exit temperature through use of heating elements and/or cooling pipes in the tool
- Determine temperature changes in tool between different extrusion cycles

Virtual Die Trials:

- Visualize material flowing through the die passages
- Determine causes for flow imbalance
- Study responses to design changes
- Perform 'what-if' studies to test innovative die designs

Tool Deflection Analysis:

- Coupled flow, thermal, and stress analysis solver
- Calculate die deflection and mandrel shift during extrusion using RADIOSS™
- Minimize tool deflection to meet product tolerances
- Identify causes for tool breakage
- Optimize the shape and size of backers and bolsters using Altair® OptiStruct®

Comprehensive Material Database:

- HyperXtrude comes with a database of commonly used polymers and tool
- Built-in calibration module to fine tune material properties
- User subroutines enable users to add new material models

Contact Friction:

- Power law model
- Slip velocity based model

Optimize Dies & Production:

- Optimize the die designs using Altair® HyperStudy® to modify land lengths and mandrel dimensions
- Optimize process conditions:
 - Extrusion speed
 - Melt temperature

Polymer Viscosity Models:

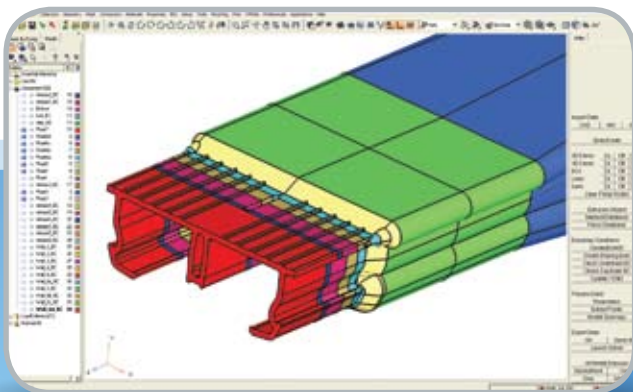
- Power law
- Carreau Yasuda model
- Cross and Modified Cross model
- Herschel-Bulkley model
- Criminale-Erickson-Filby model (visco-elastic)

Temperature Dependence:

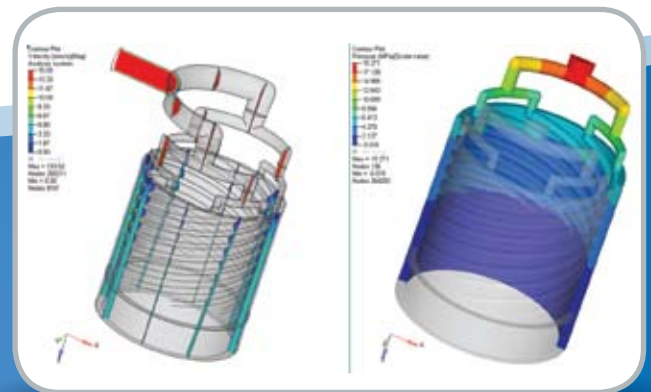
- WLF
- Arrhenius
- Cross and Modified Cross model
- Criminale-Erickson-Filby model (visco-elastic)

Results:

- Extrusion load
- Force and energy balance
- Material flow balance
- Profile shape changes
- Strain and strain rate
- Flow stress
- Temperature in tool and work piece
- Tool deflection and stresses
- Velocity vectors and contours
- Particle traces
- Plotting features: Animations, vector plots, contour plots, cutting planes and X-Y plots
- User-defined derived quantities



Pressure Distribution in a Multiple Hole Die



Extrudate Swell - Viscoelasticity



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