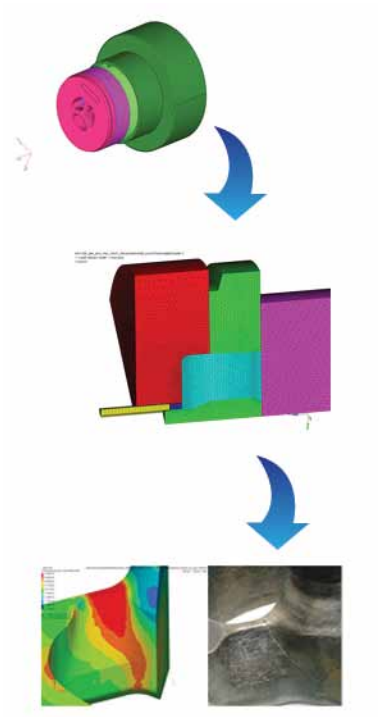
Altair® HyperXtrude®

Engineering the Metal Extrusion Process

Altair® HyperXtrude® is an engineering simulation environment for extrusion-die-design and production engineers to analyze metal 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.



Die Failure Prediction

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.
- **Increase productivity and reduce scrap:** Minimize weld scrap and backend defects and optimize billet length to avoid extruding partial sections.
- **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 manufacture profiles with proper grain size and 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
- Predict seam weld strength
- Determine correct bearing lengths
- Adjust porthole and pocket dimensions

Simulation Engineers:
- Design proper tool support.
- Predict tool wear and failure
- Troubleshoot problem dies
- Thermal management

Production Engineers:
- Determine optimum process conditions
- Reduce scrap
- Maximize recovery

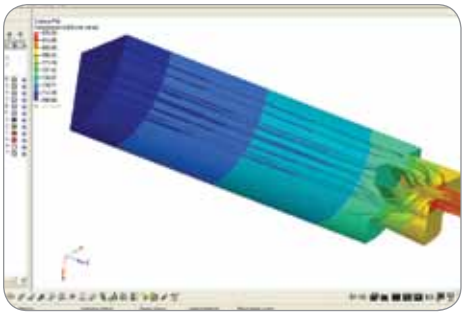
Quality Engineers:
- Determine product quality
- Optimize grain size and recrystalization
- Calculate profile yield strength

Capabilities

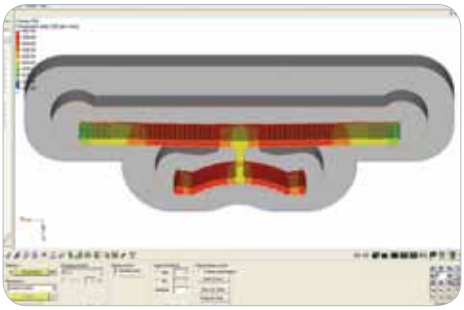
HyperXtrude is a CAE tool used for virtual testing, validation, correction, optimization of extrusion process and die designs. Using HyperXtrude's broad capability set, engineers can identify design errors before they become costly problems.

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

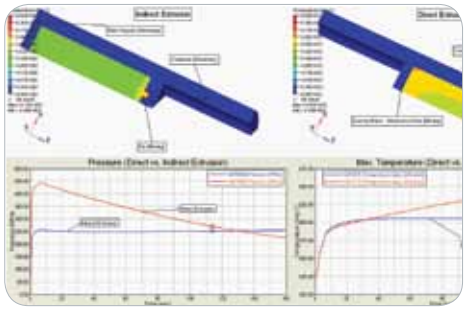
Support for All Die Types:
- Solid, semi-hollow, and hollow profiles
- Multihole dies
- Feeder plates and spreader dies
- Direct, indirect, and conform extrusion processes



Temperature on Die and Container Walls



Profile Temperature



Indirect Extrusion vs. Direct Extrusion

Predict Extrusion Defects:
- Profile shape prediction
- Surface defects
- Track surface impurities and prevent them from entering the profile
- Determine transverse weld length
- Predict the quality of seam welds in the weld chamber
- Predict grain size and tensile yield strength of the profile

Thermal Management:
- Determine optimum billet preheat using HyperXtrude/PROCESS
- 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 alloys for tool and work piece materials
- Built-in calibration module to fine tune material properties
- User subroutines enable users to add new material models

Contact Friction:
- Visco-plastic friction model
- Coulomb friction model
- Slip velocity based model

Optimize Dies & Production:
- Optimize the die designs using Altair® HyperStudy® to modify bearing lengths and pocket dimensions
- HyperXtrude/PROCESS :
  - Calculate optimum process conditions: ram speed, billet preheat, taper
  - Press selection – optimize throughput
  - Optimum billet length – reduce scrap
  - Quote preparation
  - Cost analysis

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
- Profile grain size, yield strength
- Seam weld strength
- Billet skin tracking
- Transverse weld length
- Velocity vectors and contours
- Particle traces
- Plotting features: Animations, vector plots, contour plots, cutting planes and X-Y plots
- User-defined derived quantities

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