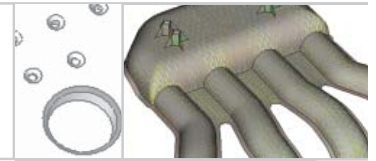


MPI/Fiber



MPI/Fiber predicts the fiber orientation due to flow in fiber-filled plastics and the resultant mechanical strength of the plastic/fiber composite.

It is important to understand and control the orientation of fibers within fiber-filled plastics to reduce shrinkage variations across the molded part to minimize or eliminate part warpage.

Capabilities

MPI/Fiber allows you to:

- Predict fiber orientation and thermo-mechanical property distributions in the molded part
- Predict elastic modulus and average modulus in the flow and transverse flow directions
- Predict linear thermal expansion coefficient (LTEC) and average LTEC
- Calculate Poisson's Ratio, a measure of the transverse contraction of a part compared to its length when exposed to tensile stress
- Optimize filling pattern and fiber orientation to reduce shrinkage variations and part warpage
- Increase part strength by inducing fiber orientation along load bearing part surfaces

Supported Model/Mesh Types:

- Finite-element midplane models
- Solids-based Fusion models (add-on option)
- True 3D solid models (add-on option)

Supported Analysis Integrations:

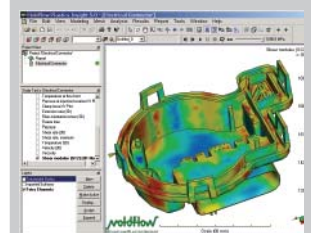
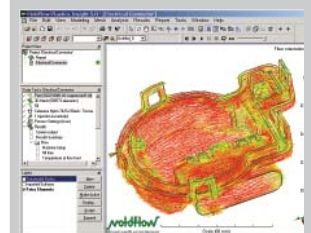
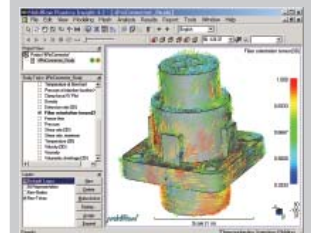
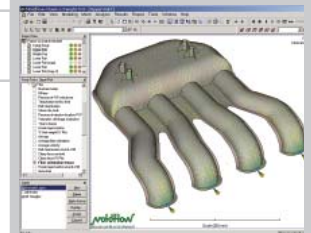
- Requires MPI/Flow:
 - To perform filling analysis and determine orientation of fibers due to flow within the cavity

Links to MPI/Warp:

- Enables accurate prediction of shrinkage and warpage of complex parts using fiber-filled materials

Links to MPI/Stress:

- The predicted fiber orientation at the end of packing and the mechanical properties of the filled plastic are input to MPI/Stress to perform a structural analysis to determine the effects of fiber orientation on structural integrity





- Provides thermo-mechanical property data for calculation of in-mold (residual) stress
- Filler database stores material data for the most common filler materials:
 - ┆ Glass fibers
 - ┆ Carbon fibers
 - ┆ Aramid fibers
 - ┆ Asbestos fibers
 - ┆ Boron fibers
 - ┆ Metals
 - ┆ Minerals
 - ┆ Synthetics
- Utilizes the polymer flow history from MPI/Flow simulations to predict the fiber orientation and thermo-mechanical properties asymmetrically through the thickness of the part
- The equation of change for the fiber orientation calculation is based upon the Tucker-Folge modified Jeffrey model
- Composite property calculation based on existing models:
 - ┆ Tandon-Weng (default)
 - ┆ Halpin-Tsai (optional)
 - ┆ Krenchel (optional)
 - ┆ Cox (optional)
 - ┆ Ogorkiewicz-WeidmannCounto (optional)
 - ┆ Schepery, Chamberlain, and Rosen-Hasin for thermal expansion coefficients
 - ┆ Advani-Tucker orientation model for thermo-mechanical properties
- Uses a hybrid scheme to calculate heat transfer, which couples boundary element method cooling simulation with the finite-difference method to accurately capture the mold/melt interface dynamics

- Includes a fiber-interaction calculation to improve accuracy for fully characterized fiber-filled materials containing concentrated suspensions
- Input material is defined by fundamental micro-mechanical material properties:
 - ┆ Elastic moduli
 - ┆ Poisson's Ratio for plastic and fiber
 - ┆ Fiber length
 - ┆ Fiber aspect ratio
 - ┆ Weight fraction
 - ┆ Volume fraction
 - ┆ Typical data required for an MPI/Flow analysis

Results:

- Average fiber orientation
- Fiber orientation tensor
- Fiber direction
- Thermo-mechanical properties of the composite material
- Standard results from MPI/Flow, including:
 - ┆ Fill time
 - ┆ Pressures
 - ┆ Temperatures
 - ┆ Weld lines and air traps more features

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