Simulation Services for Injection Molded Plastic Components

Who we are:
The Plastics Engineering Group is supplier of engineering services for the development of plastics products and the simulation of plastic part manufacturing processes.

Advantages for our Customers:
• improved product quality
• reduction of development time
• optimized manufacturing processes
• cost savings
• increase of customer satisfaction

What we offer:
Our scope of activity is the optimization of injection molded parts, the associated molds and the injection molding process using leading finite element based simulation tools (MOLDFLOW, ANSYS, ...).

• Moldflow analyses
• meshing services (midplane modelling, shell meshes, solid meshes)
• CFD modelling
• structural analyses
• design of experiments (DOE)
• consulting service for the development of plastic parts
• training
• anisotropic structural analysis

Facts:
• MOLDFLOW users since 1989
• proven record: > 11,000 projects
• MOLDFLOW experience > 180 years
• access to all MOLDFLOW applications

Our philosophy:
Our daily mission on behalf of our customers is shaped by our commitment to best service and highest quality standards. We develop secured and practice-relevant solutions considering the technical goals and economic interests of our customers.

Contact: Sven Theissen (Dipl.-Ing.)
Phone: +49 (0)6151 / 8504 020
Email: theissen@pe-group.de

Thomas Wittmann (Dipl.-Ing.)
Phone: +49 (0)6151 / 8504 010
Email: wittmann@pe-group.de

PEG GmbH • Robert-Bosch-Str. 7 • D-64293 Darmstadt • Germany
Phone: +49 (0)6151 / 8504-0 • Fax: +49 (0)6151 / 8504-099
info@pe-group.de • www.pe-group.de
**Generation of High Quality**

**Finite Element Models**

---

**Our Strengths - Your Advantages:**

- day to day service
- guaranteed intime delivery
- flexible capacities
- fixed rates
- avoid waste of expensive expert resources

---

**Models for all Application Areas:**

- midplane models
- shell meshes for
  
  *Moldflow, Ansys, Abaqus, LS-Dyna, Nastran, ...*

- solid meshes for
  
  *Moldflow analyses*
  
  *structural analyses*
  
  *acoustics analyses*
  
  *CFD applications*

---

**Our Modelling and Meshing Tools:**

- ANSA
- CATIA
- IDEAS / UG / NX
- ICEM
- HYPERMESH
Full Analysis Service
Analyses and Optimization of Injection Molded Plastic Components

Structural Analyses:
- thermal expansion analyses
- linear/nonlinear statics and dynamics with contact
- structural optimization
- modal- and frequency response analyses
- buckling analyses

Moldflow Analyses:
- MPI, Midplane, Fusion, 3D
- Fibre, Warp, Cool, Gas, Sequential Filling, Overmolding, Dynamic Feed, Co-Injection, MuCell, Injection Compression, Reactive Molding

The Plastics Engineering Group:
- experienced Moldflow users since 1989
- proven record of more than 11000 projects
- individual and multilingual reporting
- up to date software applications
- multifaceted CAD data import

Contact:
Sven Theissen (Dipl.-Ing.)
Phone: +49 (0)6151 / 8504 020
Email: theissen@pe-group.de

Thomas Wittmann (Dipl.-Ing.)
Phone: +49 (0)6151 / 8504 010
Email: wittmann@pe-group.de
MOLDFLOW analyses
Mold design and process optimization

Moldflow applications:
- Autodesk® Moldflow® Insight (AMI) used
- Midplane, Fusion and 3D meshing technology
- Filling simulation
- Runner design and runner balancing
  - Sequential gating
  - Dynamic Feed®
- Cooling channel design and optimization
- Shrinkage and warpage prediction
  - Including fiber orientation effects
- Special processes
  - In-mold decoration (film, wood, metal)
  - Overmolding of part inserts (hybrid)
  - 2K injection molding
  - Gas injection molding
  - Injection compression molding (ICM)
  - Reactive injection molding (RIM)
  - Co-Injection
  - Mucell® process (microcellular foam)

Moldflow analyses offer you:
- Increased part and mold quality
- Shorter cycle times
- Reduced efforts during molding trials
- Stable molding processes
- Better understanding of the complex rheological and thermal phenomena during molding

Our offer contains:
- Short response times
- Timely delivery of our services
- Analysis fee communicated in advance
Analysis goals & problem definitions

Part / cavity:
- Gate placement, general ability to fill the part, position of weld lines and air traps, pressure and clamp force requirements, shrinkage holes, thermal and mechanical loading on the melt, cooling time, part deflection (shrinkage and warpage)
- Process window and process capabilities
- Part deflection: Tolerance compliance, part flatness, part roundness, position of holes, screw bosses and other functional features
- Part inserts taken into account
- Core deflection
- Identification of jetting phenomena

Hot and cold runner systems:
- Number and positions of the injection points
- Runner balancing, minimizing the clamp force requirement, avoiding flash
- Dimensioning of the gates for most effective packing
- Hot runner layout and valve gate timing for sequential gating
- Hot runner layout and pressure profiles (Dynamic Feed*) for single cavity, multi cavity, family and stack molds...

Cooling channel layout:
- Determination and optimization of the cycle time
- Detecting thermal vulnerabilities like hot spots and other non-uniform cooling issues
- Cooling channel layout, channel dimensioning and process settings like flow rates and temperatures
- Optimizing the cooling system with mold inserts (Ampcoloy, copper, BeCu, heatpipes, ...)
- Part deflection due to thermal influences

Special processes:
- In-mold decoration (IMD): Assessment of thermal and mechanical loading on the film
- Part inserts: Thermal and mechanical effects
- Overmolding: Thermal effects of A-component on B-component, vice versa shrinkage and warpage analysis of A- and B-component coupled
- Gas injection molding: Placement of gas needles and overflow cavities, gas channel penetration, final polymer wall thickness, fingering processing parameters like gas delay time, gas pressure profile, ...
- ICM: Clarify advantages of ICM over conventional molding, compression forces, thermal and mechanical loading of the melt, processing: Volume to be filled, press-open distance, closing profile, ...
- Co-injection: Determining (thickness) distribution of skin and core components penetration of core component
- Mucell®: Weight savings, sink marks, bubble distribution Processing: Initial volume to be filled, gas concentration, ...
MOLDFLOW analyses
Low Pressure Molding

**Hotmelt technology:**
- Ability to fill the part
- Filling animations
- Position of weld lines
- Position of air traps
- Venting
- Pressure and clamp force
- Overmolding and bonding
- Runner and gate dimensioning
- Freeze time
- Shear rates and shear stresses
- Shrinkage & warpage
- Process optimization
- Gravity, inertia & jetting

**Reactive technology:**
- Reactive molding
  - Epoxy, EMC, LSR, rubber, ...
  - Conversion
  - Curing kinetics
  - Venting and air pressure
- Microchip encapsulation
  - Paddle shift
  - Wire sweep

**Your advantages:**
- Less development time
- Higher quality standard
- Optimized production processes
- Cost savings
- Less claims and complaints

= CUSTOMER SATISFACTION
Scope of tasks:

- Structural analysis of plastic-, metal- and composite parts
  - Pressure load cases
  - Thermal load cases
  - Crash- and droptests
- Tool dimensioning
- Process coupled structural mechanics

Benefits:

- Prediction and evaluation of stresses, strains and deformations
- Evaluation of strength and deformation requirements
- Prediction of functionality, reliability and safety reserves
- Reduced test effort
- Close-to-production prototype
- Better understanding of the general mechanical behavior

Our offer contains:

- Short response times
- Timely delivery of our services
- Analysis fee communicated in advance
filling simulation coupled with structural mechanics

Application:
- Specific part design
- Weight optimization
- Analysis of weld line quality

Benefits:
- More accurate and realistic results
- Consideration of fiber orientation
- Taking the microstructure into account

Technology:
- Non-linear non-isotropic approach
- “MAPPING”: ideal numerical models for process simulation and structural analyses
- Virtual material laboratory
- Definition of any material model with different base polymers and fillers

Consulting Services:
- Material testing & validation
- Moldflow fiber solver adjustment
- Analyses & optimisation
- Evaluation projects

Our offer:
- Coordination of medium-term development projects
- Possible cooperation with leading “Plastics Institutes” in Darmstadt, Germany
- First certified German Digimat service provider
<table>
<thead>
<tr>
<th>Consumer + Packaging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport Box 40 l</td>
</tr>
<tr>
<td>Tooth Brush</td>
</tr>
<tr>
<td>Tool Box</td>
</tr>
<tr>
<td>Suitcase</td>
</tr>
<tr>
<td>Suds Bowl (Washing Machine)</td>
</tr>
<tr>
<td>Stack Box</td>
</tr>
<tr>
<td>Spray Cap</td>
</tr>
<tr>
<td>Sleeve</td>
</tr>
<tr>
<td>Rubber Broom</td>
</tr>
<tr>
<td>Plastic Broom</td>
</tr>
<tr>
<td>Margarine Tub</td>
</tr>
<tr>
<td>Garbage Can 210 l</td>
</tr>
<tr>
<td>Garbage Can 120 l</td>
</tr>
<tr>
<td>Electric Toothbrush Housing</td>
</tr>
<tr>
<td>Dryer Housing</td>
</tr>
<tr>
<td>Dryer Front Panel</td>
</tr>
<tr>
<td>Dryer Door</td>
</tr>
<tr>
<td>Dryer</td>
</tr>
<tr>
<td>Creme Jar</td>
</tr>
<tr>
<td>Cooker Hood, Gas-Assisted</td>
</tr>
<tr>
<td>Cooker Hood</td>
</tr>
<tr>
<td>Condensing Dryer Drum</td>
</tr>
<tr>
<td>Bucket</td>
</tr>
<tr>
<td>Brush Head</td>
</tr>
<tr>
<td>Bottle Box</td>
</tr>
<tr>
<td>Bottle</td>
</tr>
<tr>
<td>Blister</td>
</tr>
<tr>
<td>Blade Box</td>
</tr>
<tr>
<td>Beauty Cover</td>
</tr>
<tr>
<td>72 Cavity Preform Mold</td>
</tr>
<tr>
<td>48 Cavity Preform Mold</td>
</tr>
<tr>
<td>32 Cavity Preform Mold</td>
</tr>
<tr>
<td>10 Cavity Preform Mold</td>
</tr>
<tr>
<td>5 Cavity Preform Mold</td>
</tr>
<tr>
<td>Consumer + Packaging</td>
</tr>
<tr>
<td>Water Tank</td>
</tr>
<tr>
<td>Valve Cover 6 Zyl</td>
</tr>
<tr>
<td>Valve Cover 4 Zyl</td>
</tr>
<tr>
<td>Truck Valve Cover</td>
</tr>
<tr>
<td>Throttle Body Flange</td>
</tr>
<tr>
<td>Trim Engine Hood</td>
</tr>
<tr>
<td>Transducer Cylinder</td>
</tr>
<tr>
<td>Tooth Wheel</td>
</tr>
<tr>
<td>Tank Inlet Neck</td>
</tr>
<tr>
<td>Tank Hutch</td>
</tr>
<tr>
<td>Tank Flange</td>
</tr>
<tr>
<td>Steam Partition</td>
</tr>
<tr>
<td>Spring Panel</td>
</tr>
<tr>
<td>Spring Bracket</td>
</tr>
<tr>
<td>Spindle</td>
</tr>
<tr>
<td>Shift Fork Housing</td>
</tr>
<tr>
<td>Shift Fork</td>
</tr>
<tr>
<td>Sealing Frame</td>
</tr>
<tr>
<td>Retainer</td>
</tr>
<tr>
<td>Radiator Shroud Single</td>
</tr>
<tr>
<td>Radiator Shroud Double</td>
</tr>
<tr>
<td>Radiator</td>
</tr>
<tr>
<td>Radial Fan with Metal Retainer</td>
</tr>
<tr>
<td>Automotive Power Train</td>
</tr>
<tr>
<td>Meshing Services</td>
</tr>
</tbody>
</table>

**Record of Projects/Experience 2/2**

**Automotive Power Train**

PEG GmbH • Robert-Bosch-Str. 7 • D-64293 Darmstadt • Germany

Experience 2/2

Record of projects / power window housing

Get in touch with us:

info@pe-group.de • www.pe-group.de

Phone: +49 (0)6151 / 8504-0

Leading by Simulation