CAST-DESIGNER™

CAST-DESIGNER

A Full Integrated Gating System Designer for Pressure Die Casting

From Part Design … Mould/Die Design … to Casting Quality Control
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What is Cast-Designer?

From Part Design … Mould/Die Design … to Casting Quality Control
What is CAST-DESIGNER?

- A Gating System Designer for High Pressure Die casting
- Designer application includes gating system, overflow, cooling system, and venting system
- Standard alone software
- Standard and special data exchanger for CAD/CAE system
Application of CAST-DESIGNER

- Casting die design and manufacture
- Pre-processor of CAE system to design/modify the gating system
- Powerful mesh capability to support FEA model and CAE simulation system
Main Features of CAST-DESIGNER

- Read in 2D/3D casting part directly
- Automatically 3D gating system design
- Full parameter design
- Natural design concept, 3D draft design
- Data exchange with CAE system
- Flexibly, simple for operation
- Design database and customize
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Software Interface

From Part Design … Mould/Die Design … to Casting Quality Control
User’s Interface

- Windows style
- Module design
- Engineering
- Flexible
- CAD/CAE
User’s Interface (Mesh)

Same environment for both CAD and mesh data
Full Integrated CAX Environment

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Working Process

From Part Design … Mould/Die Design … to Casting Quality Control
Gating System Designer

- Workspace design
- Draft design
- Gating system design
- Overflow design
- Cooling channel and venting design
- Gating system check
Natural Design Concept

System Design

Functionality

Specific Values

Parameters
Natural Design of Gating System
Natural Design of Gating System

1. System Design
2. Functionality
3. Parameters
4. Specific values
1. Inner gate
2. Gate runner
3. Runner
4. Sprue runner
5. Shock absorber
Gating System Designer: Inner gate

1. Ingate list
2. Ingate data
3. Ingate prop.
4. Coordinates
5. Function
Gating System Designer: Inner gate

Guide for ingate velocity (for Al, Zn):

<table>
<thead>
<tr>
<th>Part Average Thickness (mm)</th>
<th>Average Velocity (m/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>46.55</td>
</tr>
<tr>
<td>1.5~1.5</td>
<td>43.52</td>
</tr>
<tr>
<td>1.5~2.0</td>
<td>46.49</td>
</tr>
<tr>
<td>2.5~3.0</td>
<td>37.46</td>
</tr>
<tr>
<td>2.5~3.8</td>
<td>34.43</td>
</tr>
<tr>
<td>3.9~4.5</td>
<td>31.40</td>
</tr>
<tr>
<td>4.6~5.1</td>
<td>28.20</td>
</tr>
<tr>
<td>6.4</td>
<td>25.32</td>
</tr>
</tbody>
</table>

Liquid velocity for runner and gate (Consider die life time):

<table>
<thead>
<tr>
<th>Alloy</th>
<th>Velocity of runner (m/s)</th>
<th>Velocity of gate (m/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al</td>
<td>10</td>
<td>Max 35</td>
</tr>
<tr>
<td>Zn</td>
<td>35</td>
<td>Max 35</td>
</tr>
<tr>
<td>Cu</td>
<td>25</td>
<td>Max 40</td>
</tr>
</tbody>
</table>

Flow rate histogram.

Innergate Users guide

Ingate Evaluation

- Total defined ingate area (mm$^2$): 422.12d8671
- Mass (kg): 2.03
- Volume of casting part (kg):
  - Al (2400):
  - Zn (6400):
  - Cu (7500):
  - Mg (1650):
  - Pb (9000):
  - Sn (7000):
- Alloy density (Kg/m$^3$):
  - Al (2400):
  - Mg (6400):
  - Cu (7500):
  - Mg (1650):
  - Pb (9000):
  - Sn (7000):
- Filling velocity (m/s):
  - Al (40) (20~60):
  - Mg (40) (40~60):
  - Cu (30) (20~50):
  - Zn (40) (30~50):
- Filling Time (sec): 0.05
  - Average thickness: 2.0
  - Filling time: 0.03~0.08
  - Predicted ingate area (mm$^2$): 422.916667

Check | Cancel
Gating System Designer: Gate-runner

Working plane: X0Y, X0Z, Y0Z

Location: UP, DOWN

Start angle: 90 deg

Last angle: 105 deg

Smooth shape

Flow angle1

Flow angle2

Alpha1

Beta1

Last Section

4th Section

3rd Section

2nd Section

Beta2

First Section

Alpha2

Length
Feature line for Gate-runner
Gating System Designer: Gate-runner

- Pick pre-defined curve directly.
- Using for complex 3D Gate-runner.
- Feature points could be modified
- No limitation for feature points and feature lines.
- Dimension of gate-runner could be controlled
- Two parameters for draft angle (DraftL, DraftR);
- Two parameters for runner width (WL, WR);
- Triangle section is possible depend the input data.
- Adjust tool for both coordinate and width.
Gating System Designer: Runner

- Similar method for runner and gate-runner;
- Suitable simple shape for long flow (WL=WR).
Gating System Designer: Sprue runner

- Full parameter for sprue-runner;
- Hot chamber and cold chamber;
- WYSWYG;
- Online evaluation for machine selection.
Gating System Designer: Sprue runner

- Center point of piston biscuit
  - Position: X: 155, Y: 155, Z: 0
  - Reference Axis Direction: Axis Direction
- sprue-runner location: UP
- Working plane: XOX, YOZ, VOZ
- Nozzle Diameter (d): 20
- Biscuit height (L1): 10
- Base diameter (D1): 55
- Sprue thickness (t): 3
- Runner depth (D): 8
- Runner width (W): 0
- Draft Angle (a): 10

Diagram showing:
- Stationary Platen
- Ejector Platen
- Hydraulic Cylinder
- Gooseneck
- Plunger
- Holding Pot
- Liquid Metal
- Furnace
- Cover Die
- Ejector Box
- Ejector Die
- Nozzle
Gating System Designer: Shock Absorber

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**Defined shock absorber list**

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>Diameter</th>
<th>Angle</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ShockAbsorber_1</td>
<td>20</td>
<td>5</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>ShockAbsorber_2</td>
<td>20</td>
<td>5</td>
<td>30</td>
</tr>
</tbody>
</table>

- Full parameter;
- Support Multi group definition.
- WYSWYG.

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**Shock Absorber**

**Name:** ShockAbsorber_2

**Center**

- X: 0
- Y: 0
- Z: 0

**Axis Direction**

- 0

**Diameter:** 20

**Draft Angle:** 5

**Height:** 30
Gating System Designer: Final turning

Fine turning the designed CAD and simple the surface data. Filling, Chamfer, simple geometry, sew faces ...
Boolean operation, smooth geometry ...

It is suggest to come back 3D CAD system for final design (for manufacture) however we provide functions for CAE users.
Gating System Designer: Final turning

Fine turning the designed CAD and simple the surface data. Filling, Chamfer, simple geometry, sew faces … Boolean operation, smooth geometry …

It is suggest to come back 3D CAD system for final design (for manufacture) however we provide functions for CAE users.
Overflow design (I)

- Standardized, full parameter
- Build in Rectangular, orbicular, wedge overflows
- Pre-defined data template
- Support multi overflows
- Flexible location and rotation
- Data export and import
- Support customization

![CAD_Overflow interface](image)
Overflow design (II)
Cooling Channel design

- Pre-defined centre line for cooling channel (Import or generation)
- Section shape and dimension control
- Support multi channels and multi section definitions
- Automatically Boolean operation
Venting Channel

- Pre-defined centre line for cooling channel (import or generation)
- Section shape and dimension control
- Support multi channels and multi section definitions
- Automatically Boolean operation
- Support draft angle and partition plane
Venting Block

- Support venting system in HPDC;
- Full parameter;
- Flexible location control;
- WYSWYG
Gate System Checking

Section Checking  Filling Ratio  Casting Yield  Shot Checking

Check section and section area
Check filling ratio
Casting yield checking
Casting machine checking and selection

Provide a serial tools to check/evaluate the design.
Gate System Checking: Section Checking

Checking the section shape and area

Checking Point:
- X: 20
- Y: 25
- Z: 125

Parallel Section Number: 23
Section Distance: 10

Dimensions:
- 242.279
- 156.378
- 144.753
- 140.174
- 143.958
- 143.128
- 141.160
- 137.849
- 133.805
- 129.815
- 126.397
- 123.012
- 119.587
- 116.344
- 112.765
- 108.549
- 104.033
- 101.392
- 100.861
- 99.721

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Gate System Checking: Filling Ratio

- Select piston diameter;
- Filling ratio of piston;
- Predict the 1st and 2nd speed;
- Calculate the critical accelerate point;
- WYSWYG.
Gate System Checking

- Casting yield.

- Predict locking force.
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Examples

From Part Design … Mould/Die Design … to Casting Quality Control

www.c3pgroup.com
Automotive Part (I)

Part with draft background

Part with Gating System
Automotive Part (II)

Cooling feature line

Gating System with Cooling line
Automotive Engine Cover

Draft design for feature lines

Final design
Design Optimization – Plate (1)

Original design

Simple Gate-Runner

Increase inner gate area
Design Optimization – Plate (2)

Design -1

Design-2
Cooking panel

Design -1

Design -2
Oil panel  (Automotive)
Holder

Full 3D gating system for complex partition surface
Automotive part

Full 3D gating system for very complex partition surface
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Couple to Simulation

From Part Design … Mould/Die Design … to Casting Quality Control

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Couple Cast-Designer with simulation software

- **What CAE can do?**
  - Base on Input data, provide output result
  - Detail casting information: filling, solidification, stress etc.

- **What CAE can not do?**
  - How to modify the existed model
  - How to fast design a new plan

- Cast-Designer can couple any CAE system as a pre-process for gating system, both FEM and FDM/FVM.
  - MAGMA, Pro-CAST, Flow3D, AnyCASTING, PAM-QUICKCAST, NOVACAST, JSCAST ...

- Cast-Designer support STL/IGES/STEP and mesh data
From CAD to Mesh

- Powerful mesh capability in Cast-Designer
- Automatically 2D and 3D mesh, fast and high quality
- Power mesh edit functions
Mesh assembly can assemble two surface mesh to a connected mesh in a fast way.
CAD/CAE Example: Philips Iron Design
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Conclusion

From Part Design ... Mould/Die Design ... to Casting Quality Control

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Major Benefits of CAST-DESIGNER -1

Very fast design speed

- General design time in Cast-Designer
  - Standard casting ➔ Tens minute to one hour
  - Complex 3D partition surface ➔ 1~2 hour

Easy to use

- Function module design
- Similar interface for all components
- Full parameter design, pre-defined template

Natural design style

- Natural design style, draft design approach
- Support multi design plans
Major Benefits of CAST-DESIGNER -2

**Fully integration**
- CAD export (STEP, IGES, STL)
- CAM export (STL)
- CAE integration and data exchange

**Design checking and evaluation**
- Online guide and wizard
- Special tools for design checking and evaluation

**Easily customization**
- Design database generation and customization
THANK YOU!

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