Digital Prototyping at FIAT

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Class Summary

In this class you explore how Autodesk® Moldflow® and Autodesk® Showcase® software can visualize manufacturing defects in plastic parts and how Moldflow® results can improve SIMULIA® Abaqus® simulation of thermal load.
Learning Objectives

At the end of this class, you will be able to:

- Visualize part defects using Autodesk® Showcase® rendering capabilities with homemade graining database
- Improve the thermal load simulation of plastic assemblies with injection molding residual stresses results
Visualization as an engineering communication tool

FIAT Punto Evo

Interior Sink Marks Visualization

Alfa Romeo Giulietta

Dashboard Flush Gap Simulation under Thermal Load
Interiors Sink Marks Visualization
Interiors Sink Marks Visualization

- Dashboard upper cover - sink mark estimate
- Glove box - comparison between simulated and real part
- Door panel - comparison between simulated and real part
We have studied three interior parts...

- Dashboard upper cover
- Glove box
- Door panel
...and made a comparison with real parts
Interiors Sink Marks Visualization

Material database

Process conditions

Visualization
Interiors Sink Marks Visualization

Ø2

Ø4

Ø4.25
Interiors Sink Marks Visualization

Dashboard upper cover

Real part
Without graining

Sink mark estimate (through process simulation)
Interiors Sink Marks Visualization

Glove box - Process

Sink mark estimate [mm]
Mid Pressure

Sink mark estimate [mm]
Low Pressure
Glove box - Low pressure - Visualization

Part weight 362 g
not ok with D21 graining

Interiors Sink Marks Visualization
Interiors Sink Marks Visualization

Glove box - Mid pressure - Visualization

Part weight 372 g
ok with D21 graining

Glove box - Mid pressure - Real part
Glove box - Mid pressure
Without graining

Glove box - Mid pressure
Lighter emboss than D21 not cover defects
Interiors Sink Marks Visualization

Real door panel
Without graining

Sink mark estimate
(through process simulation)
Interiors Sink Marks Visualization

Real door panel
With graining

Visualization
OK! Graining and process have been tuned to cover defects!
Interiors Sink Marks Visualization

Real door panel
Without graining

Sink mark estimate (through process simulation)
Interiors Sink Marks Visualization

Real door panel
With graining

Visualization
Ok with D21 graining
Dashboard Flush Gap Simulation under Thermal Load
Dashboard Flush Gap Simulation under Thermal Load

- Classical simulation
- Process oriented simulation
- Glove box: comparison of calculated and experimental data
- Fuse box: comparison of calculated and experimental data
Dashboard Flush Gap Simulation under Thermal Load

Dashboard assembly

3D CAD data → FEM model for every component → Dashboard assembly

Thermal load (gravity) → Flush gap → Comparison with cockpit flush gap

Classical Simulation
Dashboard Flush Gap Simulation under Thermal Load

- 3D CAD data
- FEM model for every component
- Dashboard assembly
- Thermal load (gravity)
- Flush gap
- Comparison with cockpit flush gap
- Process Oriented Simulation
- Injection molding simulation
Dashboard Flush Gap Simulation under Thermal Load

- Thermoplastic parts modeled for accomplish both software programs mesh request
- Parts fixed to the body in white
Dashboard Flush Gap Simulation under Thermal Load

Glove box flush gap points of measure

Fuse box flush gap points of measure
Dashboard Flush Gap Simulation under Thermal Load

Glove Box Flush Gap Comparison

Classical Simulation
Process Oriented Simulation
Experimental Data

Relative Displacement (mm)

Points of measure
Dashboard Flush Gap Simulation under Thermal Load

Fuse Box Flush Gap Comparison

- Classical Simulation
- Process Oriented Simulation
- Experimental data

Points of Measure

Relative Displacement (mm)
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