CATIA for Composites
Design & Manufacturing Preparation
Design and produce: better, stronger and lighter

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Compositi Expo Congress
13/14 ottobre 2010
3° Congresso dedicato alle tecnologie
dei materiali compositi a matrice polimerica,
ceramica e metallica applicata al campo dei trasporti
Gruppo Dassault Systèmes

3D MCAD  Virtual  Product  Virtual  Testing  Virtual  Production  PLM  Collaboration  Life  Experience

«Creazione forme « Realtà & geometrie » Tangibile »

« Esperienz a »
Dassault Systèmes nel mondo
Una società, soluzioni di eccellenza

DASSAULT SYSTEMES SA (France)

- 6 840 persone
- 146 sedi in 27 paesi
- 1.177 Milioni di euro
"Aumentate la competitività dei clienti"
Typical needs of the composites industry

Reduce the costs of:
- non quality: produce as designed, tailorability
- trials, mock-up: virtual performance tests, manufacturing processes simulation
- raw materials: material use from design mock up

Be efficient:
- Work as a global team with an integrated solution

Be productive:
- Work with the best in class solution

Innovate:
- Industrialize the processes

Optimize weight and performances:
- Drive the design choices
- Design in context
DS fulfills your needs and help innovation

CATIA, SIMULIA, DELMIA and DS Partners for an integrated end-to-end composites process from design & simulation to manufacturing & simulation

- Nesting
- Laser Projection
- Tape laying
- Fiber Placement
- Resin Transfer Molding

Expected gain: ~ 30% overall
Design intent & Design context

Define the right part configurations by designing in the context of assembly.

Optimize the performances and weight by designing in the context of analysis.

Produce better and cheaper by designing in the context of manufacturing.
CATIA for Composites: The backbone of an extended solution

+ other solvers
CATIA Composites: From shapes to Laminates

Initial Design – Surfaces & geometry preparation

- Manual plies creation

- Solid & Tapers Zones

- Transition Zones Edges

Plies – Detailed Design

Engineering Deliverables

Digital Mock-Up Integration

Manufacturing Preparation

Confidential Information
What is a ply in CATIA?

- A material
- An orientation
- A contour on a surface
- A fibers simulation (draping process)
- A position in the stacking
- A representation
The « Ply Lifecycle management » in CATIA

Automatic plies creation from functional design

Ply N
Ply 3
Ply 2
Ply 1
- A material
- An orientation
- A contour on a surface
- A fibers simulation
- A position in the stacking
- A representation

Finite Element Analysis

Manufacturing preparation
- Material excess
- Spring back
- Fiber analysis
- Darts, splicing
- Flattening
- Ply book, export

Engineering Deliverables
- Drawings
- DMU
- Tables, reports
- ...
Engineering deliverables...

- Drawings
- DMU
- Tables, reports
-...

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<th>Ply</th>
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<th>Direction</th>
<th>Rosette</th>
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- Solid/Top surface from plies
- IML (Inner Mold Line)
- Analysis, Core Sample
- Ply table
- Drawings with Generative view style
- Drawing with Annotation templates
Manufacturing Preparation

Manufacturing preparation

- Material excess
  - Spring back
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Solid and tapers approach

The creation of the plies contours computed on the solid ensure the respect of the geometric tolerance.
Zones and transition zones approach allows to dedicate areas to assembly interfaces, and manage the drop off on dedicated areas.
The zones and staggering approach allows a perfect tuning on the plies limits contours at the transition between two zones.
Grid approach

Based on geometries coming from the assembly context, driven by analysis specifications, and compliant with manufacturing challenges.
Engineering deliverables, DMU integration...

- Drawings
  - DMU
  - Tables, reports
  - ...

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Integrated composite structural analysis

Finite Element Analysis

- Fiber deviations
- Mesh
- Composite properties
- Load case
- Solving
- Postprocessing
Solution

- Rules based automatic process planning of composite plies
- Reuse engineering ply data in planning
- Deliver accurate as-planned and as-designed information to the shop floor
- End to end process coverage with DS V5 Partner solutions

Results

- Reduce Planning time up to 90%
- Avoid re-work with error free communication
- Minimize design changes with feedback
3D VIA for e-ply book

3D Via Composer reads natively CATIA Composites entities. It allows the diffusion of electronic ply book and training manuals to the shopfloor.
Mature Ecosystem of Manufacturing Solutions

- **Automated Tape Laying**
  - TORRES LAYUP V5
  - TAPE GENERATION+TAPE MANUFACTURING
  - Tape Laying Advanced CPS Interface
  - ACE V2 Tape Laying and Fiber Placement Composite CAA V5 Interface

- **Automated Fiber Placement**
  - iCPS for Designer + iCPS for NC Programmer
  - ACE V2 Tape Laying and Fiber Placement Composite CAA V5 Interface
  - TORFIBERDES + TORFIBERMAN
  - CATFiber Export CAA V5 Interface
  - FP Standard Composites Design + FP Virtual Production
  - Composites Strategy CAA V5 based + FiberLay + NC Composites Machine Simulation

- **Hand Lay-Up**
  - TruLASER View Composite + TLV Light View Composite
  - TruNEST Composite CAA V5 Interface
  - PANOGEN Nesting Solution for Composites Part Programming

- **RTM / VARTM, RFI**
  - PAM-RTM for CATIA V5
Solution architecture (1 of 2)
Solution architecture (2 of 2)