iCPS – Ingersoll Composite Programming System The Integrated Suite for Composite Manufacturing





INGERSOLL COMPOSITE PROGRAMMING SYSTEM





iCPS (Ingersoll Composite Programming System), is a complete solution for the design, manufacturing and analysis of a composite part

iCPS/Designer

Helps engineers optimize the layup of composite parts

- Layup method strategy definition
- Continuous surface definition
- Surface updating

iCPS/NC Programmer and Analysis

Automates the manufacturing process of composite parts

- Analysis of the manufacturability of a part
- Ply generation
- Fiber paths deviation and curvature analysis
- Link with analysis to automate the update of the FEA model
- Definition of automated fiber placement operation
- NC data generation

iCPS Advantages:

- One native Catia V5 platform to design, manufacture and analyze a composite part.
- No interface needed.
- Optimum Fiber path design through the use of native continuous CAD geometry.
- No Lay-up discontinuity due to the possibility to incorporate Surface Topology and Manufacturing constraints during the design of the Laying Surface support to guarantee a free JERK machine motion.
- Generate intermediate Surfaces to ensure smooth machine transitions across varying ply thickness distributions.

iCPS - CAAV5 Software Partner



REFERENCES: 5–10 CUSTOMERS

- iCPS/Designer and iCPS/NC
 - Airbus
 - Lockheed
 - Boeing
- Target Markets:
- Aerospace, Defense and Automotive
- Design and Manufacturing Depts.
- Proven Customer Benefits:
- One platform to design, manufacture and analyze a composite part
- Optimum fiber path design through the use of continuous geometry description
- Allows the NC Programmer to locally control Process parameters.
- Take advantage of the possibility to customize machine off-part motions in order to minimize parasite time
- Preview Head Motion to avoid collisions
- Model Roller deformation and feasibility for any Surface curvature distribution.
- Direct Link with FEA solver such as Nastran and Abaqus to automatically update bulk data file to reflect what will be the manufactured part.

iCPS – Ingersoll Composite Programming System

- Fiber Placement Strategy - Fiber Placement Strategy - Point St	
VOUR FIRER PLACEMENT STRATEGY	Fiber Placement Strategy ? Layup Method: Constant Angle Parameters
 Allows the designer to specify the fiber placement layup strategy Different layup strategies gygilable 	Start Point: SP 5.7 Boundary Lap/Gap: 0.5 Stagger Shift: 0 mm
 Different layup strategies available – Constant Angle – Angle Offset – Guide Offset 	Interband Offset: 0 mm Interband Gap Limit: 0.5 Interband Lap Limit: 0.5
– Tailor Fiber Path – Manual	OK Scancel

SURFACE OFFSET:

Generate intermediate Surfaces to ensure smooth machine transitions across varying ply thickness distributions.

Dage Dallace				
Use the ply group's	defined surface	(All plies must be th	e same)	
O Selected				
Simplified Surface no	selection		_	
Sequence	Ply	Thickness	Update	^
Const Ang - Odeg	Ply.1	0.1	No	
Const Ang - 45deg	Ply.2	0.1	No	
Const Ang45deg	Ply.3	0.1	No	
Const Ang - 90deg	Ply.4	0.1	No	=
Ang Offset - Odeg	Ply.5	0.1	Yes	
Ang Offset - 45deg	Ply.6	0.1	No	
Ang Offset45deg	Ply.7	0.1	No	-
Ang Offset - 90deg	Ply.8	0.1	No	
Guide Offset 1	Ply.9	0.1	No	~
Quida Officat 2	Dk. 10	0.1	Mar	-
N.				
Select All Deselect	All Invert Sele	ction		
Ply Thickness				
Edit Thickness Rev	ert To Default			
Lindaka Mathad	ore to berduic			
opuace mechou				
O Manual				
Set update	est Undete			
 Auto 				
Update every 5	Sec.	uences		
Advanced				
Draning Direction				
braping birection	Reverse Direc	tion		
Enhanced Update				
Comparation miller				
		A	1	- 1











Tool Path Review

- Preview Head Motion
- Collision Avoidance



PLY OPERATION DEFINITION

- Define the manufacturing operations
- Define global process parameters (Compaction heater, tension, etc.

Composite Part Operation.1 Manufacturing Program.2 Tool Change.1 Roller.1 MPly Operation.1



TOOL PATH ANALYSIS

Allows the NC Programmer to analyze:

- Off Part Motion
- Laying Motion
- Fiber Path Discontinuity
- Trimming



– Ply Comparison

- Angle Deviation
- In plane Curvature (Steering)



SURFACE SIMPLIFICATION

- Creates a continuous parametric surface definition
- Possibility to incorporate topology and manufacturing constraints

Tool Path Customization

Allows the NC Programmer to customize:

- Vectors Orientation
- Course Customization
 - Laying Order
 - Remove
 - Reverse
 - Break
- Adjust ply process information











- Allows the NC Programmer to locally control process parameters such as:
 - Compaction Force
 - Compaction Temperature
 - Tow Tension
 - Feedrate
 - Dynamic Pinch Control
- Better Layup quality on honeycomb, foam, fiber glass and otherwise difficult surface contouring.



Advanced Off Part Motion

- Allows the NC Programmer to optimize the machine motion between courses
- Improve cycle time



FEA Link

Compare theoretical and manufactured fiber angles



Ply: 1
Real: -0.611065 Ply: 1
the second s
4 Theoretical: 9 Real: -0.000242326 Ply: 1
20200 U.D
ElemId: 436 Theoretical: 0 Real: 1.06874 Ply: 1
and the second
retical: 0 Real: 4.00726 Ply: 1
ElemId: 418 Theoretical: 6. Real: 2.03263 Ply: 1
ented 435 II Theoretical: 0 II Real: 5 59015 II Ply: 1
ElemId: 400 Theoretical: 0 Real: 2.6332 Ply: 1
Real: 0.0302429 [] Ply: 1
ElemId: 417 Theoretical: 0 Real: 1.22259 Ply: 1
Theoretical: 91 Real: 6.07383e-006 Ply: 1 ElemId: 382 Theoretical: 0 Real: 5.75308 Ply: 1
Elemid: 399 Theoretice: 0 Real: 1.20532 Ply: 1 Elemid: 17
27597 Ply: 1 Theoretica: U Keal: -0.122222 Ply: 1
Elemid: 361 Theoretical: 0 Real: -1.622

COMPLETE PROCESS SIMULATION



iCPS PROGRAMMING

- Composite part definition
- Ply operation definition
- Compaction modeling
- Ply computation
- Tool path analysis
- Tool path customization
- Off part motion customization
- FEA link









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