Manufacturing Cost Model for Composite Parts

Physics-Based Mechanistic Cost Models

The Challenge of Cost Estimation for Composites

Advanced composites have become the material of choice for many product designs due to their high strength to weight ratio, corrosion resistance, and durability. Given these benefits, most modern aircraft and other aerospace vehicles have a significant percentage of primary and secondary structures manufactured with composites, and their use is increasing in industries such as automotive to support light-weighting initiatives. Making the decision to use composites involves consideration of performance and weight criteria, but must also consider design and manufacturing costs. With it's globally respected cost modeling solution, aPriori gives design and manufacturing stakeholders detailed visibility into end to end costs associated with manufacturing composite parts and assemblies. The result is that design engineers, cost analysts, manufacturing engineers and sourcing professionals can make informed design and manufacturing decisions that directly impact profitability.

aPriori Meets the Challenge from CAD to COST

aPriori captures the complex geometric and non-geometric information from the 3D CAD model to establish a bottom up cost estimate to manufacture the composite product. aPriori automatically reads the design information from industry leading composite solutions from Siemens (Fibersim) and Dassault Systems (CPD). This enables quick and comprehensive assessment of product manufacturing costs directly from the master product definition. aPriori reads composites information directly from the CAD model file, without the need to manually enter the information, saving time and reducing the possibility of user error.

Benefits of aPriori Cost Modeling for Composites

- All cost modeling stakeholders get a detailed cost breakdown including material, labor, overhead and tooling for early insight that previously was only available after the build process
- Design engineers can conduct trade studies to evaluate the impact of alternative designs, materials, and manufacturing processes
- Design engineers can use the cost estimates and ply complexity analysis to optimize composite designs for cost and improve manufacturability
- Senior leadership uses the cost estimates obtained using the aPriori Digital Factory to determine the best production site for the composite part.
- Sourcing managers can effectively negotiate supplier contracts with detailed should cost breakdowns of the composite designs
- Suppliers can increase bid win rate and sustain profit on build-to-print composite work packages

Figure 1: Fibersim Composite Part Costed in aPriori

Figure 2: CATIA CPD Composite Part Costed in aPriori

Cost Modeling the Manufacturing Process

The aPriori mechanistic costing engine simulates the build process and determines the cycle time and associated costs for all operations in the process. Product complexity factors such as material properties, cutout areas, ply size and curvature are automatically assessed to simulate production floor operations.
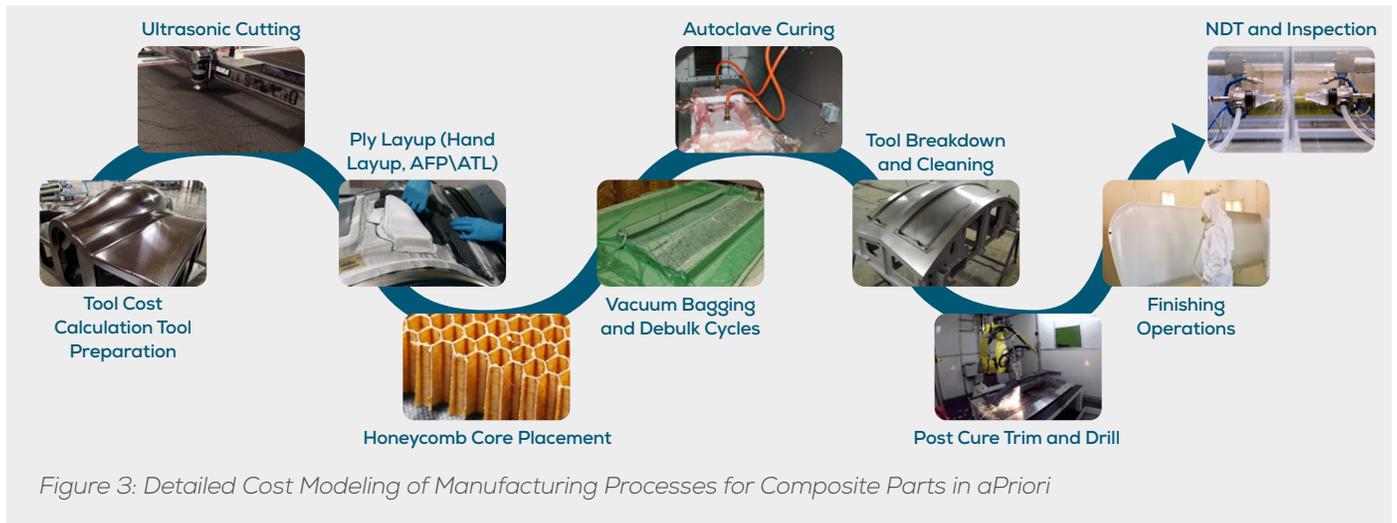

Ultrasonic Cutting

Ply Layup (Hand Layup, AFP\ATL)

Autoclave Curing

NDT and Inspection

Tool Breakdown and Cleaning

Tool Cost Calculation Tool Preparation

Vacuum Bagging and Debulk Cycles

Finishing Operations

Honeycomb Core Placement

Post Cure Trim and Drill

Figure 3: Detailed Cost Modeling of Manufacturing Processes for Composite Parts in aPriori

Extending the aPriori Manufacturing Insights Platform

The aPriori composites costing module further extends the existing solution capabilities to credibly estimate costs associated with common manufacturing processes such as:

Additive Manufacturing, Bar and Tube Fabrication, Casting, Extrusion, Forging, Machining, Sheet Metal Forming, Plastic Molding, PCBA and Wire Harness, Assembly, Secondary Processes, Test and Inspection.

With this comprehensive and expanding set of cost models, aPriori helps design and manufacturing firms develop cost estimates for parts, assemblies, and fully assembled products across diverse industries. Firms can optimize entire product designs for cost and manufacturability, pick production sites with the lowest fully burdened production costs and maximize profit margins across the product portfolio.

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