get it right®

INFUSION PROCESS SIMULATION FOR LARGE AND/OR COMPLEX COMPONENTS WITH PAM-RTM

HOW TO EFFICIENTLY EVALUATE MANUFACTURING STRATEGIES AND OPTIMIZE PROCESS PARAMETERS

KEY BENEFITS

- Cut tooling and process cost
- Speed up mold design and injection system definition
- Optimize injection/curing cycle time
- Reduce porosity
- Minimize resin waste
- Decrease mold weight

TYPICAL APPLICATIONS

- **ENERGY:** wind blades
- **AERONAUTICS:** spars, wingbox, self-stiffened panels, PAX/cargo doors, windows frames, HTP, VTP
- **MARINE:** hulls, decks, innerliner, military panels
- **AUTOMOTIVE:** floorpan, pillars, hoods, back-lid, bumpers
- **CIVIL ENGINEERING:** bridges, tanks

Infusion is a process widely used to manufacture large components such as wind blades. However, when the required design reaches dozens of meters with different composites materials and inserts, infusion can be very challenging. It is often after multiple expensive trials (cost of fibers and resins, cleaning of the mold, labor time...), that a working manufacturing process is found.

Any small improvement in the design or modification in the material lay-up, sequence or type might compromise the "working process" to manufacture the component and consequently multiply development costs.

PAM-RTM: The industrial simulation solution

PAM-RTM simulation software covers a wide range of manufacturing processes based on liquid composite molding. This includes Resin Transfer Molding (RTM), Vacuum Assisted RTM (VARTM), and Vacuum Assisted Resin Infusion (VARI).

PAM-RTM accelerates time to market by providing users with a rapid decision-making solution for preliminary design, for process and mold optimization as well as final design verification.

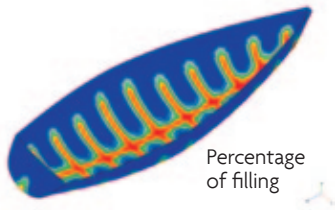
PAM-RTM helps engineers minimize the risk of producing defective parts by mastering all parameters of the manufacturing process. Resorting to simulation, engineers leverage the benefits of producing high performance composite parts.

Including for very large components...

Regardless of model size, within industrial computation times, PAM-RTM takes into account potential 3D aspects of the manufacturing process, such as the influence of the flow media and the flow around the inserts.

PAM-RTM covers a wide range of validated processes, allowing to determine the best combination of resins and fibers

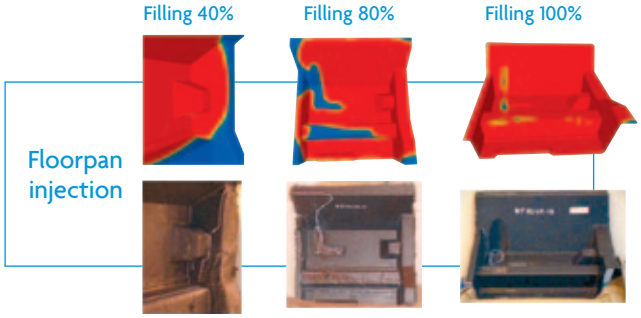
Preforming	Resin	Pre-heating	Filling & Curing	Product
Account for the flow modifications resulting from preforming.	Quickly evaluate virtually any type of resins in terms of viscosity and kinetics.	Master thermal issues through a comprehensive thermal modeling spanning mold pre-heating to final part curing.	Track flow front like in a transparent mold and analyze through the thickness impregnation.	



Percentage of filling

PAM-RTM helps define and optimize:

- Injection strategy
- Injection pressure or flow rate
- Molding temperature
- Location of injection gates, vents and vacuum ports
- Flow media



And includes numerous capabilities:

- High performance solver for the detailed simulation of very large structures within industrial computation time
- One shot simulation for quick estimation of last points to fill and filling time
- Automatic estimate of injection point location
- Conditional opening and closing of gates
- Draping for realistic fiber orientation

PAM-RTM is part of ESI's Composites Simulation Suite encompassing dedicated industrial software to simulate the design, performance and manufacturing of composite parts.

SELECTED REFERENCES

Airbus, Azimut Yacht, BIAM, Boeing Research & Technology Australia (BR&TA), CCAT, Chengdu Aircraft Corp., CRC-ACS, Dassault Aviation, EADS/IW, Eurocopter, GE, Hexcel, ONERA, PPE, Tensyl, Teijin.

ABOUT ESI GROUP

ESI is a world-leading supplier and pioneer of digital simulation software for prototyping and manufacturing processes that take into account the physics of materials. ESI has developed an extensive suite of coherent, industry-oriented applications to realistically simulate a product's behavior during testing, to fine-tune manufacturing processes in accordance with desired product performance, and to evaluate the environment's impact on product performance. ESI's products represent a unique collaborative and open environment for Simulation-Based Design, enabling virtual prototypes to be improved in a continuous and collaborative manner while eliminating the need for physical prototypes during product development. The company employs over 750 high-level specialists worldwide covering more than 30 countries. ESI Group is listed in compartment C of NYSE Euronext Paris. For further information, visit www.esi-group.com.

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