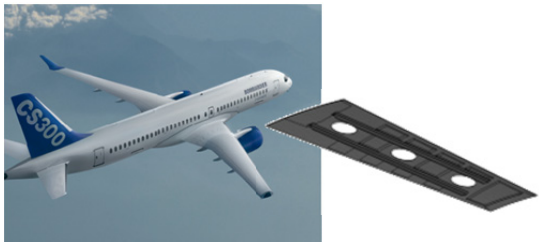
Deutsches Zentrum für Luft- und Raumfahrt

Handout

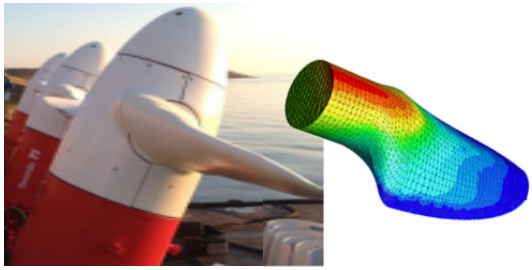
ECOMISE

Enabling Next Generation Composite Manufacturing by In-Situ Structural Evaluation and Process Adjustment

Car Suspension Blade (Volume Part Use Case)



Aeronautic Wing Cover (Large Part Use Case)



Tidal Turbine Blade (Complex Part Use Case)

Within current composite part development and manufacturing processes a disproportional high effort is implied in order to find optimal process parameters and to meet required qualities and tolerances of high performance light weight structures. The ECOMISE project aims to enable next generation of thermoset composite manufacturing and post-processing. Within this project high precision process techniques for advanced dry fibre placement (AFP), infusion/ injection (RTI/ RTM) and curing were developed in order to maximize process efficiency at reduced costs and production time due to less material consumption, higher reproducibility, less energy, less waste and less rework.

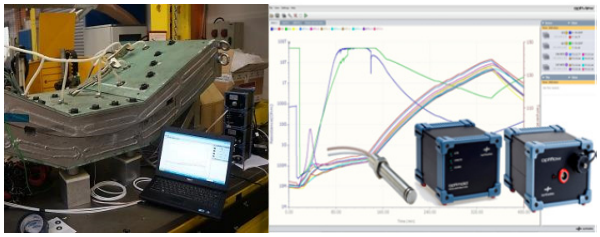
Objectives of the project

Higher utilization of composites with improved performance without a cost increase:

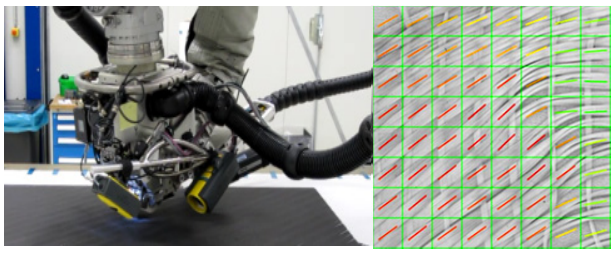
- Significantly reduced process costs
- Increased process robustness and thus, increased product performance without cost increase
- First-time-right manufacturing for high complex parts without costly manufacturing trials or rework

Decrease of raw materials, energy consumption and emission during manufacturing:

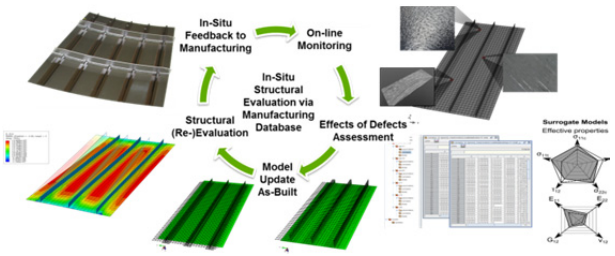
- Minimum manufacturing trials during ramp-up
- More efficient preforming and infiltration processes during series production
- Minimized rework by in-situ process adjustment
- Minimized post-processing and assembly by considering composite part distortions.
- Minimize energy consumption and resulting CO2/ NOx emission by shortened process cycles



Online Resin Monitoring



Online Fibre Monitoring



In-Situ Structural Evaluation

For further detailed information please visit www.ecomise.eu or contact the ECOMISE project leader:

Dr. Tobias Wille
DLR Braunschweig
tobias.wille@dlr.de
+49 531 295 3012

Concept of the Project

The *ECOMISE Manufacturing System* combines four technology modules. Links between these modules are supported by a newly developed Manufacturing database. In order to enable in-situ capabilities including uncertainties surrogate modelling techniques are exploited.

- *Probabilistic Process Prediction*: New simulation techniques were developed and implemented in order to predict the process behaviour, while taking into account statistical process variations for reliability analysis.
- *On-line Process Monitoring*: Advanced sensor system hardware and data acquisition/ analysis software were developed for monitoring for fibre deposition, resin infiltration and curing.
- *In-Situ Structural Evaluation*: Advanced simulation techniques were developed and implemented for real-time evaluation of the as-built composite structural behavior based on gathered online process measurement data.
- *In-Situ Process Adjustment*: New methodologies were developed to determine in-situ process adjustment measures via an automated decision support.

Demonstration

The resulting economic benefits of the ECOMISE approach was evaluated and demonstrated by pilot implementations for industrial use-cases, considering particularities for production of

- *volume parts*: automotive suspension blade
- *large parts*: aeronautic wing cover
- *thick complex parts:* tidal turbine blade

Here, a significant impact is expected for SME and industry end users and suppliers of composite structures as well as of facilitators providing measurement systems and software solutions.

The research leading to these results has received funding from European Community's FP7-2013-NMP-ICT-FoF (ECOMISE)

Deutsches Zentrum
für Luft- und Raumfahrt
Institut für Faserverbundleichtbau und Adaptronik
Lilienthalplatz 7
38108 Braunschweig

Dr.-Ing. Tobias Wille
Telefon: 0531 295-3012
tobias.wille@dlr.de
DLR.de