ECOMISE – ENABLING NEXT GENERATION COMPOSITE MANUFACTURING BY IN-SITU STRUCTURAL EVALUATION AND PROCESS ADJUSTMENT

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ABSTRACT

Current composite part development and manufacturing processes still requires a disproportional high effort in order to find optimal process parameters and to meet required qualities and tolerances of high performance light weight structures. Within the ECOMISE project new technologies were developed and integrated into the ECOMISE Manufacturing System in order to maximize process efficiency at reduced costs and production time of thermoset composite manufacturing and post-processing.

The ECOMISE Manufacturing System combines four technology modules. Within the *Probabilistic Process Prediction Module* new simulation techniques were developed and implemented in order to predict the process behaviour, while taking into account statistical process variations for reliability analysis. The *Online Process Monitoring Module* contains advanced sensor system hardware and data acquisition/ analysis software for monitoring of fibre deposition, resin infiltration and curing. A common manufacturing database enables to store process relevant data coming from simulation as well as manufacturing – allowing concurrent comparison of as-design vs. as-built. Furthermore, advanced simulation techniques were developed and implemented into the *In-Situ Evaluation Module* for real-time evaluation of the effect of manufacturing deviations on structural level gathered from online process measurement. By means of the *In-Situ Process Adjustment Module* new methodologies are provided to determine in-situ process adjustment measures via an automated and real-time decision support.

The presentation will give inside into the integrated work flow as well as the underlying technologies. The resulting economic benefits of the ECOMISE approach are evaluated and demonstrated by pilot implementations for industrial use-cases. Significant increase of process robustness, reduction of process time, reduced rework and less conservative structural requirements were achieved leading to decreased manufacturing costs, as well as consumption of material, energy and emissions.

Keywords: First time right manufacturing, in-situ structural evaluation and process adjustment, Industry 4.0

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