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DonQ Air - Promoting RTD in aeronautics SMEs of Poland, Romania and Turkey

This issue of DonQ Air newsletter is dedicated to the other 2 project proposals that are buing built within the project, in order to be submitted to the present FP7 Aeronautics call

DonQ Air is a Specific Support Action (SSA) project financed by the European Commission under the **6th Framework Programme,** aiming at encouraging R&D activities in the aeronautic-related SMEs in Poland, Romania and Turkey.

Project proposals supported by DonQ Air PROJECT

AEROPTIMUM – Aeronautics Knowledge-based Production Optimisation. High Density and Multi-Dimensional Digital Representation and Simulation of Composite Parts, Processes and Activities in Aeronautics

Composites in aeronautics is an area with significant business potential due to the inherent problems that appear in the manufacturing process and that require expert knowledge about the material, the concrete manufacturing activities that the material goes through, and the behaviors and errors appeared. Improved alignment of this knowledge will result in better engineering, reduced costs, tailored manufacturing processes and better efficiency.

Some of the needs of the aeronautics sector within the composite-related manufacturing process are clear – for instance precision and surface finishing that is compatible with cost and productivity goals. However, such performance heavily depends on many factors that can not be fully addressed during design of the different activities involved in the whole manufacturing process. They can only be partially handled, as the most appropriate design, use and configuration of a particular process activity cannot be easily anticipated, and this is one of the key aspects in obtaining zero process and activity failure. Moreover, as more complex multifunction manufacturing activities are envisaged there is also a knock-on increase, in relative terms, in the time needed to produce the suitable and optimum activity.

The challenge of AEROPTIMUM project is to design a new knowledge-based method for activities design and process control to improve the manufacturing of composite materials in terms of: accuracy, surface finish, productivity and cost performance.

The main goals of the project are:

- To develop a **holistic method for manufacturing activity design** that integrates information from the whole manufacturing process lifecycle. The developed method will be implemented within a **DECISION SUPPORT SYSTEM** that will action existing knowledge existing in the aeronautic engineering and manufacturing industry for the benefit of complex component productivity and efficiency.

- **Enhancement of VIRTUAL CONCEPT based simulation.** The development and improvement of digital information gathering from the production lines enables virtual work to be carried out. Simulations fed with on-line data are key to feed the Manufacturing Activity Knowledge Database. The information gathered from optical, visual non-contact and ultrasonic sensors assessing and predicting for instance an specific tool or machine wear-out due to specific use will permit through simulation and expert knowledge prevent manufacturing errors and to support in better process matching based on material properties, available time for the operations and observed performance.

To achieve these overall objectives, there are targeting advances on the state of the art in the following fields:

- Activity State & Use Characterisation. Through Visual Image Processing the particular state of the activity components (tools, machines…) would be characterised, as well as the temperature observed during operation.
- Activity Performance Characterisation. The performance of the results obtained in the activity would be dimensionally characterised externally and internally through 3D optical and ultra-sonic sensors.
- Activity Engineering Information Data Acquisition. The performance of the activity will be simulated based on the expert knowledge incorporated into the simulation environment
- Production Decision Support Systems. Human and Expert Database support will be provided to the final user in terms of optimum configuration, optimum process adaptation.

iTURBINE -Intelligent support system for designing aircraft engines' turbine blades

The project has a vision that will address the needs of today's and tomorrow's manufacturers – the development of **high accuracy, high precision, fast, reliable and adaptable inspection systems** that are **designed for the shop floor environment**, to be fully integrated in the production line to perform advanced **in-line inspection** of every manufactured part. This cannot be achieved by mere hardware mechanical evolution. Advanced high-precision metrology solutions should be coupled with the introduction of two new concepts for advanced quality control, namely **Virtual Parts** and **Virtual Metrology**.

The project main goals are:

- Drive the movement of CMMs from the laboratory environment to the real environment of the industrial shop-floor.
- Develop a new generation of CMMs, based on the concept of Virtual Metrology, to improve in 20% the quality, predictability and cost efficiency of design and industrial manufacturing processes.
- Develop a virtual metrology environment to remove the time and cost constraints posed by current metrology practices, by moving them into a flexible, self-learning, self-configuring and self-optimizing virtual environment.
- Implement virtual metrology tools into inspection systems to provide valuable and accurate information and data concerning the object scanned, namely information on the object's dimension, shapes, geometrical and surface characteristics. The information gathered can then be stored and used at any time during the product lifecycle, from the initial design phase right through to the production phase. This will further enhance the manufacturers ability to capture knowledge and implement it in product development and design tools, thereby improving product quality, predictability and cost efficiency.

The next generation of CMM machines to be developed in the scope of this project will have a **direct application to the manufacturing sector of aeronautical components**, namely, with application in **in-line dimensional inspection of aircraft turbine blades**, with potential utilization in other metallic and/or composite components.

This newsletter is prepared by the Romanian Space Agency in co-operation with the members of the DonQ Air project.
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