Digitally Adjustable Tooling for manufacturing of Aircraft panels using multi-point FORMing methodology

Sprawozdania

Informacje na temat projektu

DATAFORM

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Final Report Summary - DATAFORM (Digitally Adjustable Tooling for manufacturing of Aircraft panels using multi-point FORMing methodology)

The project DATAFORM focused on researching and developing digitally adjustable multi-point tooling for the manufacture of aircraft panels. DATAFORM aspired to play a key role in realising the full potential of flexible tooling by combining multi-point forming technology and robotic control technology.

The main objective of DATAFORM was the development and application of digitally adjustable tooling using multi-point forming methodology for manufacturing 3D panels of fuselage and wing cover in aviation. The DATAFORM project directly addressed the research area of aeronautics and space; 'Manufacturing' and 'Integrated design and product development' (FP6-2005-Aero-1.1 Strengthening competitiveness Specific Targeted Research Project).

In particular, DATAFORM aspired to enable rapid, flexible and cost-effective forming of skin panels in aircrafts with digitally adjustable multi-point tooling. The industrial and scientific breakthrough objectives of the project were:
(1) Fundamental exploration of digitally adjustable tooling using multi-point forming methodology for forming and fabrication. This will lead to the realisation of rapid dieless forming of skin panels and to the accurate jigless fabrication of panel structures in aviation.
(2) Solution of the key technological problems of adjustable multi-point tooling. This will lead to the development of an adjustable multi-point tooling compositing punch matrices to replace the solid dies or hard tooling.
(3) Building of integrated CAD / CAE / CAT software and robotic close-loop control devices for the modular system. This will lead to an innovative analysis and optimisation process, the automatic control of punches and quick adaptation to component design or engineering changes.
(4) Development and implementation of digitally adjustable multi-point tooling and techniques in the manufacture of aircraft products. This will lead to a reduction in tooling costs of 60 %, cut set-up time by up to 50 % and decrease traditional hard tooling lead time. It will also eliminate the need for tooling storage and increase tooling utilisation significantly.

The project was structured into six work packages (WPs) as follows:

WP 1 - Technology assessment and targets specification.

WP 2 - Research of adjustable multi-point tooling technology.

WP2 aimed to study the fundamentals of MPF methodology and explore the capabilities of flexible fabrication tooling technology for aircraft panels. A theoretical analysis on the mechanism of MPF was carried out for dieless forming applications. WP2 also studied in detail the use of the adjustable multi-point tooling technology for the procedures of joining, measurement or assembly of aircraft panels, in particular on procedures for surface positioning and non-contact measurement.

WP 3 - Development of digitally adjustable multi-point tooling.
The primary objective of WP3 was to build a novel and efficient digitally adjustable multi-point tooling system based on the principle of MPF and to develop automatic robotic control techniques for a flexible fabrication tooling. Two prototypes of dieless stretch forming tooling and jigless positioning tooling with punch matrices were developed. A CAD / CAE / CAM / CAT software platform, was also constructed to deal with the data exchange interface, different materials simulation, and fabrication process control.

WP 4 - Integration and validation.

WP4 aimed to integrate the developed hardware and software components into a DATAFORM tooling system ready for validation and its full functions, and to test and optimise the developed digitally adjustable multi-point tooling, and validate the flexible tooling with different materials for different applications.

WP 5 - Dissemination and exploitation.

WP 6 - Project management.

There were four main end results:
- fabrication of three DATAFORM tooling prototypes (i.e. multi-point stretch-forming tooling machine, multi-point press-forming tooling machine and multi-point positioning);
- integration of three DATAFORM tooling prototypes with control unit and CAD / CAM / CAE software;
- testing of dieless forming of stretching / pressing and jigless positioning.

Powiązane dokumenty

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