Standardised data for high added value machining

With a view to improving the digital industrialization chain for machining of spare parts for the aeronautical sector, the ANGEL Project, financially supported by a single interministerial fund that addresses collectively heads of HE establishments, industrialists and poles of competitivity, is focused on the issues of data. By introducing a common standard to represent and be used to exchange data, the Project aims at increasing productivity while limiting the environmental impact of production.

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When an industrialist launches the fabrication of a spare part the price of which may be in the hundreds of thousands of euros, steps must be taken to ensure that errors are reduced to a minimum. Sometimes the parts have complex geometries, sometimes also there are specific materials that call for special care when machining them.
"The idea of the ANGEL Project consisted in focusing on the information throughout the digital chain as it progresses from design stage to machining", explains Julien Le Duigou, a research scientist working at the UTC-Roberval Laboratory and involved with the ANGEL project, which ran for 2 years 2012-2014 and was financially supported by a single interministerial fund and managed by the Systematic Paris Region competitivity pole and co-certified by the poles ViaMéca and Astech.
The project brought together industrial partners such as AIRBUS, SNECMA, MESSIER-BUGATI-DOTTY, CADLM, DATAKIT, UF1, Spring technologies and relies on inputs from research scientists at UTC and ENS-Cachan.

An 'Angel' in the fabrication chain

ANGEL is an acronym in French standing for Agile Interoperable Cognitive Digital Workshop basically targets the aeronautical sector where machining parts represents huge amounts of money. Julien Le Duigou confirms that "the objective is to reduce the number of reject parts, to improve productivity by as much as 10% and to reduce impacts on the environment.
The research work focused on the industrialisation digital chain, which starts in the CAD (computer aided design) where the geometric shape of the part is modelled and ends when the digital machine tool actually machines the part to specification. Between these two stages, various CAM (computer aided manufacturing) phases intervene to define tool trajectories and cut parameters for machining.
The last but one task before finale fabrication is to model the machine process to check the code that will be forwarded to the machine-tool. Each stage calls for specific tools and software packages and therefore there are a variety of ways to represent the data.

A common language to, mutually understand each other

"ANGEL provides a homogeneous common way to represent the data and therefore the data exchanges between equipment units all along the manufacturing chain", details Julien Le Duigou. "The protocol relies on an international standard called Step-NC which is covered by ISO standard 14649. By making the data homogeneous, ANGEL effectively cancels out one stage during the machining protocol: the post-processor used to transform the CAM file, where all the data needed to make a part, into a machine-tool interpretable code.
This CAM file has a standardized data structure that can be shared and consequently it is possible today to capitalize and exploit know-how from information that is collected by existing tools", explains Julien Le Duigou, who goes on to detail "that it is this derived information that helps improve the work in hand".

Capitalising on experience

For example, numerous data relate to temperature, energy expended, lubricant volume consumed and the volume of machine metal or material chips produced. By studying the return on experience here, the industrialist should be capable of reducing certain wastes, enhancing a production methodology that is more respectful for the environment and opens the way to potential gains in productivity.
The members of the ANGEL team have already planned to build up an information base to group together the data collected by the industrialists. The members of the consortium are thinking ahead: the plan is to undertake a vast data collection programme from the industrialists' Step-NC files, grouping together a maximum amount of returns on experience (ROE).
Such a state-of-the-art base, once it has been analysed and structured will to open up numerous paths for further improvements on machining chains.