TECHNICAL UNIVERSITY OF KOŠICE
Faculty of Mechanical Engineering

HORIZON-CL4-2023-TWIN-TRANSITION-01-02: High-precision OR complex product manufacturing – potentially including the use of photonics (Made in Europe and Photonics Partnerships) (IA)

Ideas for the project:
Currently we are faced with simple and complex shapes in the manufacturing process. They have their representation in various areas of the production as automotive industry, aerospace industry, or dies, mold production and many others where the shape corresponds to the shape of the future product. In this group of future products, we can find different shapes consisting of convex, concave, flat surfaces or free form surfaces, which can be different types of materials with different physical properties, such as metallic and non-metallic materials, as well as composite materials. Each part must be produced to the recommended quality and dimension, so the manufacturing of different materials is thus a challenging task, and many industries today are dealing not only with the problems of optimization in the production process and its efficiency, but also with the influence of the process parameters on the final shape, dimension and quality of the future product. This will help the industry to effectively utilize the knowledge for machining of any material.

Our ideas for the project:
The use of different types of materials in industry varies to reduce the weight. Construction concepts are based on the use of different types of materials such as ferrous and non-ferrous metals, polymer composites, which are difficult to machine in terms of delamination and the choice of the right cutting tools and manufacturing technology. The question remains how to achieve efficient machining of these materials in terms of accuracy, surface quality and efficiency.

Previous solutions: Complex analysis of machining process and experimentally prepared samples from various materials, especially based on steel and aluminium alloys. Optimization of the machining strategies on geometric deviations of machined surfaces.

Experience and infrastructure offered:

1. Collection and evaluation of the effect of machining and cutting parameters to machined surface, macro and microstructural observations, CAD/CAM system utilization, surface texture analyse.
2. Collection and evaluation of cutting data in the machining process.

Projects solved, related to the issue:

1. Research and development of a new generation of machines for processing composite and nanocomposite materials (H2020-MSCA-RISE2017)
2. Research on the preparation of active surfaces for advanced tools produced by CNC form milling (VEGA 1/0360/15)
3. Several national projects focused on machining and its efficiency in the production of parts for the new generation of machines. The impact of machining on the quality and geometric accuracy of simple and shape complex parts using CAD/CAM and other application software support. See The Influence of Automated Machining Strategy on Geometric Deviations of Machined Surfaces (https://www.mdpi.com/2076-3417/11/5/2353), The Effect of the Machining Strategy on the Surface Accuracy When Milling with a Ball End Cutting Tool of the Aluminum Alloy AlCu4Mg (https://www.mdpi.com/2076-3417/12/20/10638), Ultimate Load-Carrying Ability of Rib-Stiffened 2024-T3 and 7075-T6 Aluminium Alloy Panels under Axial Compression (https://www.mdpi.com/1996-1944/14/5/1176)

Partners in previous research projects:
University of Minho, Politechnika Lubelska, Lviv Polytechnic National University, Czestochowa University of Technology, Slovak University of Technology

Contacts to industrial partners:
Zamak Mercator Sp. z o.o., SEZ Krompachy a.s., Dirmeta UAB

Contact:
Ing. Jan Varga, PhD.
Department of Technology, Materials and Computer Supported Production
Faculty of Mechanical Engineering, Technical University of Košice, Slovakia
Phone: +421556023508, E-mail: jan.varga@tuke.sk