MODERN TECHNOLOGIES AND SOFTWARE SOLUTIONS USED IN THE MACHINERY CONSTRUCTION INDUSTRY

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ABSTRACT: *This paper presents modern technologies and software solutions that can be used, especially in the machine building industry. The use of the Walter GPS application in this industry can lead to the optimization of machining processes, this being an advanced tool for optimizing these processes.*

KEY WORDS: optimization and simulation, cutting tool selection

1. INTRODUCTION

Machining plays a particularly important role in Industrial Engineering, being essential for obtaining high-precision and high-quality parts and components. These processes ensure the shape, dimensions and precision required for metal parts or other materials, being applied in various industries such as automotive, aerospace, or industrial equipment. In this context, optimizing the technological processing processes is vital to increase efficiency, reduce costs and ensure strict control of the quality of the final products. Walter GPS application is an advanced tool for optimizing these processes. Using this application, technological parameters such as cutting speed, cutting depth and feed can be analyzed and adjusted to maximize machine performance and minimize tool wear. The analysis and implementation of the Walter GPS solutions allows for continuous monitoring and real-time adjustment of processes, which contributes to reducing production time, material consumption and improving part durability. However, this application is not used in professional enterprises.

By **optimizing machining operations** with the Walter GPS application, companies can gain a significant competitive advantage by increasing productivity and reducing waste. At the same time, this approach allows for better alignment with the demands of modern industry, where precision and efficiency are essential for long-term success.

The optimization of technological processes aims to improve operational performance, part quality and overall production efficiency in the field of mechanical processing. The paper focuses on the identification, analysis and implementation of innovative technological solutions that contribute to reducing costs, processing time and increasing the durability of the tools used in the cutting process. There are a number of questions that can be answered: " How can the Walter GPS application optimize machining parameters?" This question aims to identify and analyze key technological parameters (cutting speed, feed, depth of cut, etc.) that can be adjusted to improve the machining process.

The next question that can be answered is: "What impact does process optimization have on the quality of the finished product and the life of the tools?" This question explores the relationship between optimized parameters and the quality of the machined parts, as well as the effects on the durability of the tools used.

The research aims to provide a detailed and practical analysis on the use of Walter GPS to bring significant improvements to machining processes.

2. ANALYSIS OF PREVIOUS RESEARCH. SYNTHESIS OF EXISTING LITERATURE ON THE TOPIC OF MACHINING AND THE USE OF OPTIMIZATION TOOLS

Machining is a vast field that has been intensively researched over the decades, with extensive applications in precision industries such as automotive, aerospace, microtechnology, and mechanical engineering. In this section, we will summarize previous research related to machining and the use of various optimization tools and techniques that have been studied and applied to improve the efficiency, accuracy, and performance of the machining process.

Machining refers to the processes by which material is removed from a workpiece using a cutting tool to obtain the desired shape. This includes processes such as milling, turning, drilling, grinding, and reaming. Over the decades, research in the field of machining has focused on multiple aspects, including improving tool performance, reducing wear, and optimizing cutting parameters.

One of the most studied topics in the field of machining is the cutting tool material and geometry. For example, research has explored the use of advanced materials for the manufacture of cutting tools, such as tungsten carbide tools and ceramics. These studies have shown that choosing the right tool material can significantly reduce wear and improve cutting process performance [1], [2].

Machining involves a complex interaction between the tool, the workpiece and the cutting process, which has led to the development of theories and mathematical models for the analysis of cutting forces. The authors of [3] and [4] explored methods for modeling the dynamics of the machining process, relying on numerical simulations and experimental tests to better understand how factors such as cutting speed, cutting angle and feed influence tool performance and part quality.

Optimization of the machining process is essential for maximizing efficiency, reducing costs, and improving part quality. Various researches have proposed innovative solutions and techniques to achieve these goals. These solutions include optimization of cutting parameters, real-time monitoring of the machining process, integration of CAD/CAM systems, and the use of artificial intelligence (AI) technologies.

One of the most important areas of research has been the optimization of cutting parameters, such as cutting speed, feed per tooth and depth of cut, to maximize tool performance and reduce premature wear.

The authors of studies [5] and [6] explored methods for optimizing cutting parameters using statistical techniques and design of experiments (DoE) algorithms. This research demonstrated that the correct choice of cutting parameters can significantly contribute to increasing productivity and improving part quality, especially in the processing of hard and complex materials.

Real-time monitoring of the machining process is an essential technique for identifying and correcting problems in the machining process. Cutting force and vibration monitoring systems have been extensively studied by Junichi Kouguchi , Hayato Yoshioka [7] **.** In this paper, an advanced method for monitoring the high-speed milling process using cutting force and vibration estimates is proposed. The method is based on the sequential quadratic regression approximation to separate the acceleration fluctuations from the tool tooth passage period and the high-frequency vibration components from the acceleration signals. The cutting forces are estimated by a mathematical model, and two characteristic values are calculated for monitoring the milling process: one for the cutting force and the other for the vibration.

P. Sivasakthivel , R. Sudhakaran investigate the machinability of hybrid metal matrix composites, in which aluminum (Al7075) is combined with silicon carbide (SiC) and

rice husk ash (RHA) particles in a proportion of 12% SiC and 8% RHA. The aim of the research is to understand how these composite materials behave during end milling operations, considering the complexity of machining conditions and milling tool geometry [8].

The integration of CAD/CAM software into the machining process has been another important topic of recent research. Studies by Huikang K. Miao , Nandakumar Sridharan , Jami J. Shah , have explored the benefits of using CAD/CAM systems to optimize machining routes and select appropriate tools. These studies suggest that the use of these software tools can reduce programming time, minimize process errors, and ensure faster and more accurate production [9].

3. SPECIFIC OBJECTIVES REGARDING MODERN TECHNOLOGIES

Among the specific objectives of the theme we can mention:

- Analyzing parameters technological advances in machining – studying cutting speed, depth, feed and other factors that influence the efficiency and quality of the machining process.
- Performance evaluation Walter GPS application – analyzing the application's capabilities to optimize technological processes and provide real-time parameter adjustment solutions.
- Identifying solutions optimization of tool and resource consumption – determining ways to minimize tool wear and material consumption, thus reducing costs and increasing the durability of the tools used.
- Improving productivity and quality of machined parts – determining how optimizing technological processes can increase the quality of final products and reduce production times.
- Comparing results obtained with traditional processes – evaluating the improvements brought about by the use of GPS Walter compared to traditional methods, both in terms of performance and economic efficiency.

By achieving these objectives, the research will contribute to the optimization of cutting processing technological processes and the improvement of industrial performance.

4. SUMMARY PRESENTATION OF THE WALTER GPS APPLICATION

Walter GPS is an advanced software that helps configure, optimize and monitor machining parameters. It was developed by Walter Tools , which offers digital solutions for optimizing machining processes. GPS Walter (Global Positioning System for Walter) helps users choose the best tools for various machining applications, improve the performance and efficiency of manufacturing processes, and manage available resources more effectively.

Among the key functionalities of the application we can highlight:

Optimal tool selection : GPS Walter uses advanced algorithms to recommend tools and equipment that best suit the material type, application and machining conditions. Users can select the process type (milling, drilling, turning, etc.) and the material to be machined (metal, stainless steel, aluminum, etc.), and the app suggests the most efficient tools for those conditions.

Calculation of the parameters of the regimes cutting: the application allows quick calculation of cutting parameters (speed, feed per tooth, depth of cut, etc.) depending on the material to be machined and the type of tool chosen. This is crucial to avoid premature tool wear and to obtain a consistent quality of the machined parts.

Optimization of costs and processing time: using Walter GPS, users can evaluate costs and processing time for each type of process and material, which helps optimize resources . The application suggests tools that minimize production time and material

consumption, while maximizing process performance and efficiency.

Integration with production systems: Walter GPS can be integrated with various production management systems (ERP or CAD/CAM software), allowing for better workflow management . This means that tool information and cutting parameters can be directly linked to production planning, thus improving collaboration between departments and reducing process errors.

THE Walter GPS APPLICATION to use the Walter GPS app, users need a computer/laptop and internet access To access the application, go to the link: https://gps.walter-tools.com .

Once you access this site, the application interface will open:

Fig.1. **SolidWorks interface**

Here we have 4 sections:

1. Application-related search - in this section, users can search for applications available for consulting Walter products or machining tools directly on the platform. These applications help users select tools and receive detailed product information. For example: for calculating the cutting speed for a specific machining operation or for selecting milling tools depending on the material being machined. Users can use the apps to get useful recommendations and technical information about Walter products, such as cutting tool selection apps for configuring machining centers.
2. Search related to tools - this option allows users to search for cutting tools and tools from the Walter catalog based on the type of tool they need. Searches are usually specific to the type of machining desired (e.g. milling, turning, drilling, etc.). For example, the user can search for " negative angle milling cutters " or " indexable inserts ." All tool options are displayed here, as well as clamping devices. This is the main tool search area, where users can find tools for various types of machining (milling cutters, drills, lathe cutters, taps, reamers, adapters, etc.) depending on the desired application.
3. Walter online catalog - contains a complete list of Walter products, including tools, Metalworking tools and equipment. All product categories available for purchase are presented here. The catalog is up-to-date and includes all technical information, product descriptions and prices. Users can explore the different product categories (e.g. cutting tools, lathe tools, indexable inserts, milling cutters, etc.) and select the product that meets their specific requirements.
4. Settings – here users can customize the platform to suit their requirements, setting preferences: country,

language, unit of measurement, ISO system used in that country, etc. This section may also include account and notification settings.

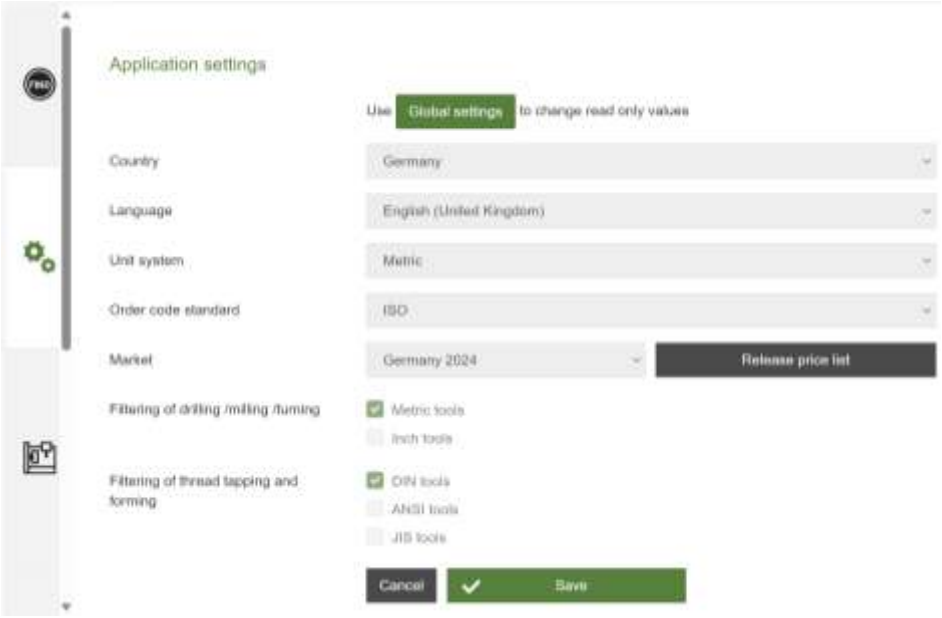

Fig.2. The eccentric device

5. OTHER TOOLS USED IN THE PROCESS OF CUTTING TOOLS

In the machining process, a wide range of tools and technologies are used to ensure efficient, high-quality and cost-effective production.

These range from the actual cutting tools to measurement and monitoring equipment that helps improve the performance of the machining process. Here is a breakdown of the most commonly used tools and technologies in this field:

- CAD/CAM software :

The Walter GPS platform can be integrated with CAD/CAM (Computer-Aided Design/Computer-Aided Manufacturing) software, which allows for part design and the creation of machining programs.

These tools are essential for production planning and ensuring perfect alignment between part design and machining process.

- Measurement and monitoring

Process: The use of measurement and monitoring systems for the machining process (e.g., vibration, temperature, or pressure monitoring systems) helps to detect problems early and prevent defects.

These tools are important for ensuring the long-term stability of the machining process.

- Cooling and lubrication systems:

In many machining processes, proper cooling and lubrication are essential to prevent tool overheating and improve cut quality. Walter Tools also offers solutions for efficient cooling systems, which help improve performance and extend tool life.

6. CONCLUSIONS

The Walter GPS application is an application that can be widely used in the machinery and equipment industry, especially in the machine building technology industry. It is an application based on which the type of cutting tool can be optimally selected, and machining processes can be optimized.

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