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Precision Tools – Saving Resources through more Efficient Technology

Making Production more efficient by using Hybrid Machine Concepts

Saving resources through innovative, digital process control

Dr. Bernd Schniering

The trend towards sustainability and resource efficiency has reached the tool industries. A sector-overlapping, digital process control, strengthened with artificial intelligence, is a crucial factor in this context. It allows for a significant increase of efficiency in using resources when producing rotation-symmetrical tools.

Complex processes – that are hard to avoid when administrating, developing, producing, and delivering precision tools – present high demands to the resource management of tool producers. For decades, the tool industry has used control mechanisms to use important resources such as energy, human sources, or financial means, efficiently. In the analog world, producer use methods like operations research (OR) and critical path planning to manage resources efficiently. For a couple of years, digital transformation methods, often referred to as industry 4.0 in media, have been increasing in relevance.

Success factor data integration

Since efficient use of resources has been increasing in importance significantly due to political and economic framework conditions, introducing a sector-overlapping, digital process control has become a critical aspect for the tool industries. Due to its high efficiency and comprehensive character, digital process control comes with crucial advantages for industrial processes.

Using artificial intelligence (AI) for increasing this efficiency can have additional, positive side-effects. Small and medium sized enterprises (SME) require targeted concepts to create the preconditions in order to realize methods of digital process control. This has to do with the fact that in particular SMEs are challenged by integrating various IT modules to set up digital process control in conjunction with artificial intelligence.

Saving resources through artificial intelligence

Integrating data is a critical success factor to ensure a sector-overlapping synchronization of data for interfaces between the required IT modules. Whenever enterprises miss the objective to integrate all of these sectors within the company, redundancy is created that subsequently torpedoes crucial targets of the digitization process.

Research and development for a digital control system

Schumacher Precision Tools GmbH from Remscheid, Germany has drawn upon scientific support to define the complete administration, design and production process and managed to build a digital copy of it. The name of this project is ToolProduction. The basic requirement for such a project comprises detailed knowledge on any relevant process and product descriptions which need to be available without redundancy before starting digitization. Realizing this project had required several research and development projects in advance. The necessary components of the control system had to be produced prior to the system itself. Core pieces of the control system includes IT modules such as enterprise resource planning systems, manufacturing execution systems, and computer aided design systems.

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Moreover, engineering modules, developed by the R&D unit of the tool producer need to be in place. This contains 3-D modeling and simulation systems – following finite element methods – amongst other required systems. Any processes for industrial SMEs need to be realized through a data architecture that is free of redundancy. This comprises order income and marketing via 3-D design, modeling, solid body simulation – following FEM method – work planning, production and process control, 3D QS management, labeling and packing standards, dispatching and after sales services on the project at the customer's site. Potential gaps in process control, such as in maintaining resources can be closed via retrofitting solutions. Various data sources are led together via IT modules and are being integrated into a central data hub. This data hub will be implemented in a relational data bank and fully integrated into the process chains of any enterprise segments of the tool producer. This creates the basis for a sector-overlapping digital process control and for a structured collection of data from any processes that allow for using artificial intelligence. In total, the use of industrial artificial intelligence at a tool producer – drawing upon digital process control – can be subdivided into seven subsections:

- flow processes
- product quality
- maintenance of machinery
- automation of production
- condition control of CNC machinery with neural networks
- design and product simulation
- demand projections

Consequences for the efficiency in SME

By using algorithms and mathematical conclusions to structure process data in core AI sections, it is possible to reduce the following negative side-effects significantly:

- wrong capacity planning
- high downtimes
- wrong attribution of resources
- errors in coordination and therefore:
- redundancy in process chains

Usually, these negative aspects are referred to as complexity costs in controlling systems. These costs can add up to 40% of total administrative costs depending on lot sizes. By applying all tools comprehensively, such costs can be reduced to 10%. By using sector-overlapping, digital process control structures with AI components, producers – in particular SME – can achieve a significantly more efficient use of resources besides winning in technology development both in products and their respective production units.

Digital process control decreases costs signficantly

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