OEE Maximization

Productivity maximization through intelligent data analysis in sheet metal processing 4.0 – Secured second-order learning of maximum productivity (21572N)

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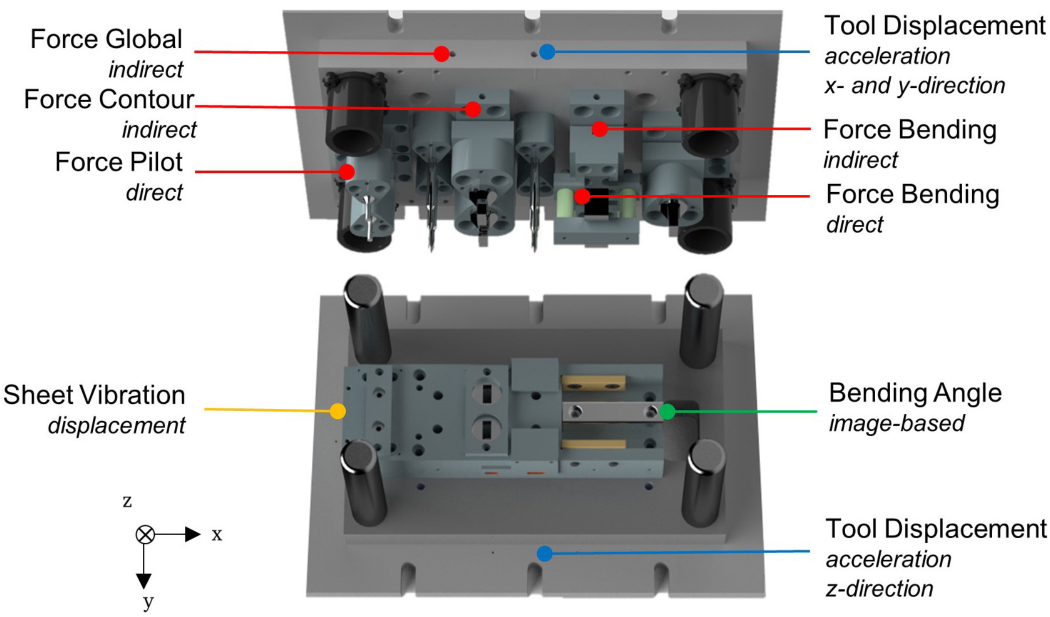
Abstract

In this EFB project, procedures for data-driven productivity maximization in high-speed forming processes with progressive dies are being developed. A self-developed, four-stage progressive die serves as an example. The design, sensor integration and qualification as well as the operation of the Progressive die with different process parameters are analyzed. The model uses correlation-based analyses and deep learning algorithms to increase productivity. The data is evaluated by intelligent algorithms and optimization measures are derived to reduce dynamic effects. This is particularly beneficial for sheet metal processing, as it enables processing companies to utilize the full economic potential of their systems and operate processes safely at their limits. Insights into sensor integration and the information potential of various sensors are generated.

Project description

Multi-stage forming processes often represent the most economically significant part of the value chain. Progressive dies combine a large number of forming processes with almost simultaneous engagement of the tools in a single press stroke. The range of parts produced using this process covers a wide area of machine, electronics, and automotive manufacturing.

In an industrial environment, Progressive dies are operated on presses at 20-100 strokes/min. This contrasts with the performance data for high-speed presses of up to 2,000 strokes/min. The reason for the discrepancy between the actual and theoretical number of strokes is a large number of control and disturbance variables on the progressive tool, the complexity of which increases as the number of stages increases. The determination of the maximum permissible number of strokes is currently based on employee expertise and is usually designed conservatively to ensure component quality and to protect the tool and machine. The aim of the project is to gain a better understanding of the process of dynamic effects in Progressive die in order to derive suitable countermeasures for increasing the number of strokes and thus extend the current process limits.



[1] Types and positions of integrated sensors

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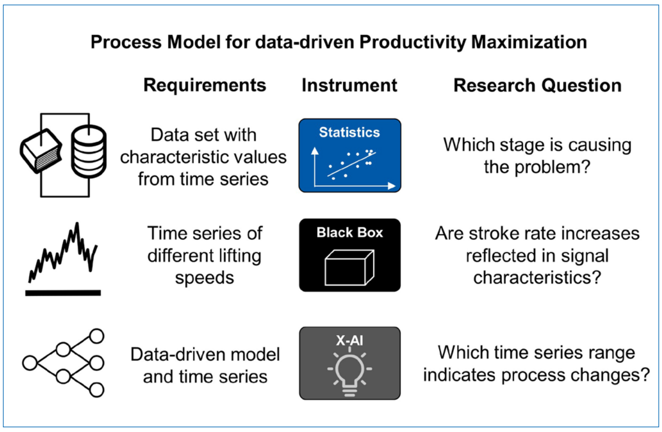
Results

As part of this project, a tool was designed, equipped with sensors and then operated with different process parameters, see figure 1. Productivity-limiting factors, such as the occurrence of unwanted vibrations or increased friction, were detected by sensors and causes were discussed using data-driven modelling. Finally, it was possible to significantly reduce the aforementioned productivity-limiting factors through targeted countermeasures, thereby ensuring robust and safe process control with higher productivity and thus greater economic efficiency. The process model developed to increase productivity is shown in Figure 2.

With such data-driven approaches, SMEs will be able to monitor relevant process variables in the future and derive suitable measures when the causes of errors are detected, which will greatly improve the safety, efficiency and stability of their processes. Increases in lifting speeds go hand in hand with a proportional increase in efficiency and delivery capability, which can massively strengthen the competitiveness of manufacturing companies.



[2] Procedure model for increasing productivity in multi-stage forming processes

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