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FRAUNHOFER INSTITUTE FOR MANUFACTURING ENGINEERING AND AUTOMATION IPA

1 *The analysis tool identifies losses caused by interlinked manufacturing processes.*

OPTIMIZATION OF INTERLINKED MANUFACTURING AND ASSEMBLY SYSTEMS

DETECT DEPENDENCY LOSSES AND HIDDEN WASTE WITHIN DISCRETE GOOD PRODUCTION

Initial situation

Companies optimize their capital-intensive manufacturing and assembly systems right from the start of operation. In doing so, process quality and overall effectiveness are getting continuously maximized. This is generally achieved by applying methods such as value stream mapping or OEE workshops. However, these methods are inappropriate to analyse short cycled, highly integrated or capsuled systems (e.g. in pharmaceutical or automotive industry). Due to high dynamics of the complex system they are unable to fully identify the relationship between cause and effect of malfunctions, thus preventing them from taking corrective action. If a system cannot reach its optimum operating point, either by a lack of availability, alternating causes of malfunctions or rapidly increasing number of variants, it directly results in insufficient amortization and therefore cost pressure.

Solution

At Fraunhofer IPA, we have developed an automated analysis method for optimizing complex manufacturing and assembly systems that can be rapidly adapted to requirements. It is based on the analysis of features contained in synchronized camera images of all processes. The installation of the cameras and the subsequent analysis phase can be done while production is running without causing any major interference. The analysis method does not only identify losses of a certain process, it also monitors the line restriction losses caused by interlinking of processes.

A patent is currently pending for the analysis and evaluation method, which was successfully implemented in projects in the automotive supply and medical technology industry.

Fraunhofer Institute for Manufacturing Engineering and Automation IPA

Nobelstrasse 12
70569 Stuttgart

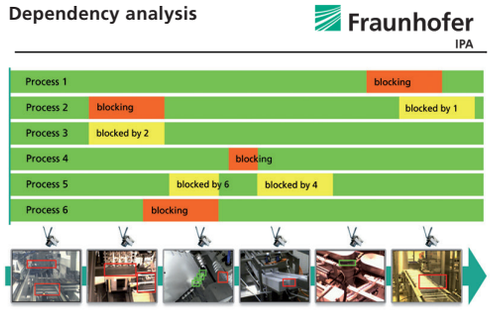
Contact
Dipl.-Ing. (FH) Timo Denner M.Sc.
Phone +49 711 970-1082
timo.denner@ipa.fraunhofer.de

Dipl.-Ing. Felix Müller
Phone +49 711 970-1974
felix.mueller@ipa.fraunhofer.de

www.ipa.fraunhofer.de

Setup of the system

Tracking and feature extraction



Analysis and classifying causes of losses

Services

The optimization approach we offer is individually adapted to the characteristics of manufacturing or assembly systems and features the following functions:

- Analysis of the productivity of individual processes and overall equipment effectiveness (OEE)
- Analysis of dependencies of malfunctions between processes, error propagation, as well as sensitivity of the tolerance chain and cause classification
- Analysis of the real automation level, as well as the need to monitor individual processes and the overall system
- Deduction of efficiency-oriented improvements and coordination rules for distributed resources (e.g. multiple machine operation, central laser energy generation for several processes, process heat distribution)
- Deduction of measures to optimize the existing manufacturing system in order to minimize identified weaknesses and dependency losses. If requested, we also draw up an implementation plan, which links these related losses to ways of increasing productivity and the necessary effort to integrate them. Evaluation of the amortisation of each remedial measure and a classification in short, middle or long term implementation
- Deduction of alternative production concepts to fully rectify the deficits identified in the existing manufacturing system, e.g. by using alternative manufacturing technologies or configurations.

In this respects it can be focused on performance indicators such as maximum overall equipment effectiveness, maximum robustness against fluctuation of parameters, or minimal investment- or life-cycle costs.

Advantages

Our analysis and evaluation system enables companies to fully grasp hidden productivity opportunities in their complex manufacturing or assembly systems. Through reduction of existing dependencies within the current system generally an increase in productivity of 10 percent can be realised. The advantages are obvious: the ongoing operation is not affected by the installation, all malfunctions are comprehensively and quantitatively detected, the cause of losses are assigned directly and lastly, the potential economic and technical benefits can be evaluated. If the optimization potential is high, we also develop alternative manufacturing concepts to match objectives regarding variant flexibility or optimal life-cycle cost, for example.

2 *The „Smart System Optimization“ can be easily and flexibly integrated during operation. Multiple cameras monitor specific features at each process step. If a variation is detected, the system allocates a cause. The software assesses whether these discrepancies result in losses at the current or other process steps. Hence productivity loss propagation is revealed throughout automated systems.*