Success Story
COMET

Pro²Future
Products and Production Systems of the Future
Programme: COMET – Competence Centers for Excellent Technologies
Programme line: K1-Centres
COMET subproject, duration and type of project: CoExCo, 04/2017-03/2021, multi-firm

Industry 4.0 at production plants – first results of CoExCo

On the way to self-optimizing polymer processing plants networking is a prerequisite. In further steps, a refined series of experiments can be developed from process data recorded in a database. Via analysis of correlation coefficients in the form of a correlation matrix one arrives at more sensitive data. Furthermore by means of big data analyzes and machine learning algorithms an improved model for control concepts can be deduced. Results from the first year of the project are presented here in more detail.

From Networking...

Based on the guiding principle of the K1-Center Pro²Future - The Future of Products and Production is Cognitive! - area 4.2 is committed to the development of cognitive production systems. The multifirm project 4.2.1 Cognitive Polymer Extrusion and Compounding (CoExCo) is being researched together with our company partners to implement Industry 4.0 in continuous polymer processing systems and processes.

Fig 1: Pipe production plant at company Poloplast (Copyright Poloplast)

On the way to the big goal of the self-optimizing system like a pipe production plant of company Poloplast (**Fig 1)** also new plant models will be developed.
Accordingly, plants were networked and, if necessary, additional sensors were installed in order to be able to monitor and archive the entire value creation process with regard to product quality, process conditions and machine settings.

... to database ...

Data is taken directly from existing OPC interfaces (usually OPC UA, OPC DA) from the plant PLC (plant control). The communication from the system to the SQL database is organized via an OPC UA server-client system of the Softing Data FEED OPC Suite (schematic representation in Fig 2). By means of a VPN tunnel, a stable and secure data transmission can be realized. A potential loss of data due to a network failure to company partners is countered by means of a local cache (store and forward). Currently, a sampling rate of about 200ms is achieved, which seems sufficient for a continuous process modeling and production monitoring.

Particular attention must be paid to the configuration of the data transfer, the data bank and the

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synchronization of the system times, as later data cleansing can only take place with extremely great effort, if at all.

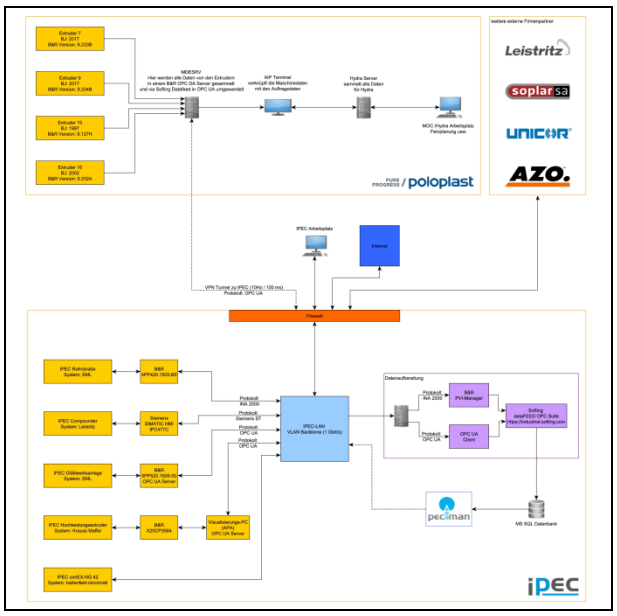

Fig 2: Schematic system networking of internal and external systems up to the database (Copyright JKU-IPEC)

... and first evaluation

Data from the database can be selected, transformed and thus prepared for initial preliminary analyzes. For pre-analyzes, correlation and determination coefficients of the system parameters are used. These should provide information about errors in the data set and options for parameter reduction.

As an example, a correlation matrix is shown here (**Fig 3**) with more than 200 system parameters. This was generated from more than 135 million data points.

Subsequently, machine learning algorithms can be trained on the reduced data sets and used to find the most important input parameters with regard to defined target parameters, but above all to quantify their impact values. Based on that, heuristic methods can be used to develop data-based models.

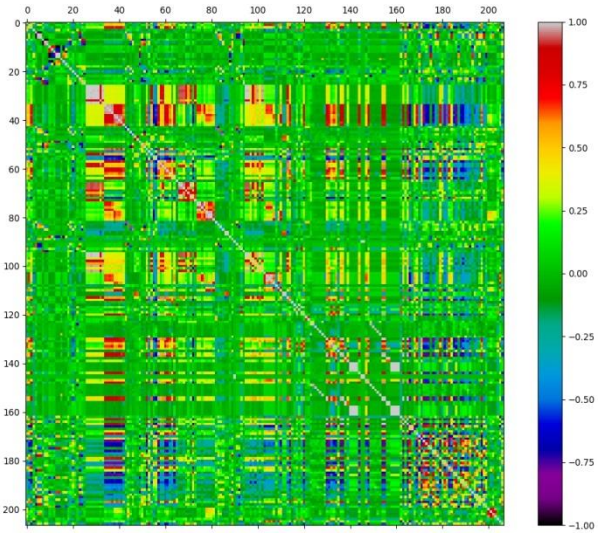

Fig 3: Correlation matrix of over 200 signals of a production plant (Copyright JKU-IPEC)

Impacts and effects

Among other things, competitive advantages and increased added value through optimized processing systems and processes are expected. This enables, for example, faster ramp-up of plants after a product change by means of improved control concepts, as well as positive effects on the environment through lower energy use.

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