

production manager

Journal for Logistics & Production

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Qualicision® simulation Anticipating and optimising stressful situations in production processes

The automotive industry is one of the most demanding industries and one of Europe's most important growth drivers. Huge pressure in terms of innovation and costs, combined with a simultaneous increase in complexity and product diversity, has led to the automotive sector playing a pioneering role in the use of sequencing systems. A smooth sequencing process plays a key role in improving the efficiency of production processes in the automotive industry.

To allow targeted detection of short-term discrepancies in ongoing production processes, e.g. faults in material provision, F/L/S Fuzzy Logik Systeme GmbH from Dortmund have developed a new tool for simulating production sequences. The tool helps users to identify the effects of

faults on a planned sequence well ahead of time and to actively counter them with temporary modifications to the sequence specifications. The tool can also be used outside the direct production environment, for strategic analysis of

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News ticker

+++ PSI Delivers Warehouse Management System to Kärcher – PSIwms controls logistics processes in expanded logistics centre
 +++ Swiss GIMOTA Group decides for PSI^{penta} ERP System – Multi-site installation for five plants
 +++ DONG Energy A/S awards contract to PSI for the delivery and implementation of a Gas Dispatching Solution
 +++ PSI receives logistics order from Latin America – Avon subsidiary in Bolivia won over by logistics optimisation software
 +++

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Editorial

Dear readers,

For more than five years, customers of the PSI Group have been able to dynamically optimise business processes and adapt the software on which they are based with the support of Qualicision® technology. This technology is used effectively in many sectors and as a result is integrated into an increasing number of PSI solutions.

We have already highlighted how Qualicision® helps to dynamically optimise processes, and the PSI solutions into which it is incorporated, in previous issues of production managers. Qualicision® covers a broad spectrum of process optimisations, ranging from production processes to maintenance and the logistical movement of goods. In

our lead article in this issue, we look at Qualicision®-based simulation. Unlike material flow simulation, the new Qualicision® simulation developed by F/L/S Fuzzy Logik Systeme GmbH is based on optimisation principles, and as such is optimisation software that enables stressful situations in processes to be contained and compensated by appropriate calculations. What's more, the whole thing is not just theoretical, it is actually being used in the automotive industry, where it is helping to create more balanced production processes. This is enabling costs to be reduced and quality improved.

Also in this issue you will find articles about how PSIwms is being used for just-in-time supply of production and assembly lines at the automotive supplier NEUE Halberg-Guss GmbH and mobile data capture with PSI^{penta}/Mobile at GEA Refrigeration Germany. You will also discover how the PSI^{metals} Rule Engine enables operational rules for all production processes—from planning, implementation, quality and logistics—to be configured and managed centrally.

I hope you will enjoy an interesting and inspiring read.

Regards,

Dr. Rudolf Felix
 Managing Director
 F/L/S Fuzzy Logik Systeme GmbH



◀ *Continued from page 1*

planned production sequences and simulation of virtual production lines. Due to the individualisation of vehicles, the European automotive market is characterised by a huge degree of product diversity. Customers generally want their vehicles to be customisable and to be able to make changes to the features of their vehicles as late as possible before the start of production. As a result, the ability to incorporate customer requirements into the calculation of sequences as late in the day as possible is a crucial advantage for any manufacturer.

Qualicision®: Enhanced Fuzzy technology for sound decisions

With its Qualicision® technology, F/L/S Fuzzy Logik Systeme GmbH has been a successful provider of sequencing solutions for well-known automotive manufacturers for more than 20 years. Qualicision® stands for qualified decision support for optimising business processes. The technology is based on Fuzzy logic that has been extended to complementary effect and helps to incorporate decision-making expertise into business processes in the form of software. Fuzziness in business processes is not only the result of uncertainty regarding the process data used. It also results from the sheer variety of data and interactions between the different options for controlling and optimising these business processes and the process goals; in other words the 'key performance indicators' (KPIs). To control and optimise business processes, interactions are recorded in the form of matrices (impact matrices) based on process data. From these impact matrices, a mathematical conflict

and compatibility analysis is used to calculate the alternative decisions that should be chosen to achieve the process goals as effectively as possible. In technical terms, a conflict and compatibility analysis allows the so-called combinatorial variety of control options to be managed with a view to the optimisation of KPIs.

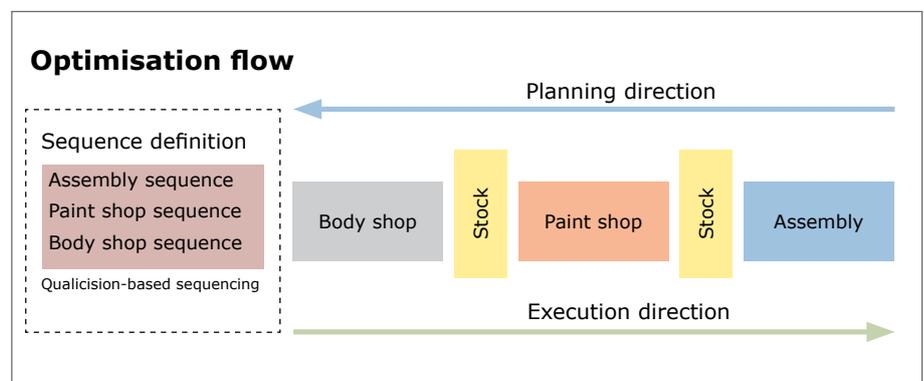
Using Qualicision® technology

Qualicision® technology is already being used to create production sequences in the body production, paint shop and assembly departments. These sequences are created just a few days before the actual start of production and sent to the affected internal and external suppliers (see optimisation flowchart). To verify these sequences,

Inventory disturbances could be caused by e.g. a lack of orders (vehicles to be produced) in a particular paint colour, or a shortage of particular seat components. The Qualicision® simulation enables the user to anticipate before the start of production the time at which or the order after which resequencing will be necessary, and what adjustments to the sequence specifications will be required to enable the planned orders to actually be produced.

Qualicision® simulation process

Qualicision® simulation is used offline as an additional tool alongside the online production systems. This enables both the planner and the controller to draw on current production data or expected production data and to use the simulation

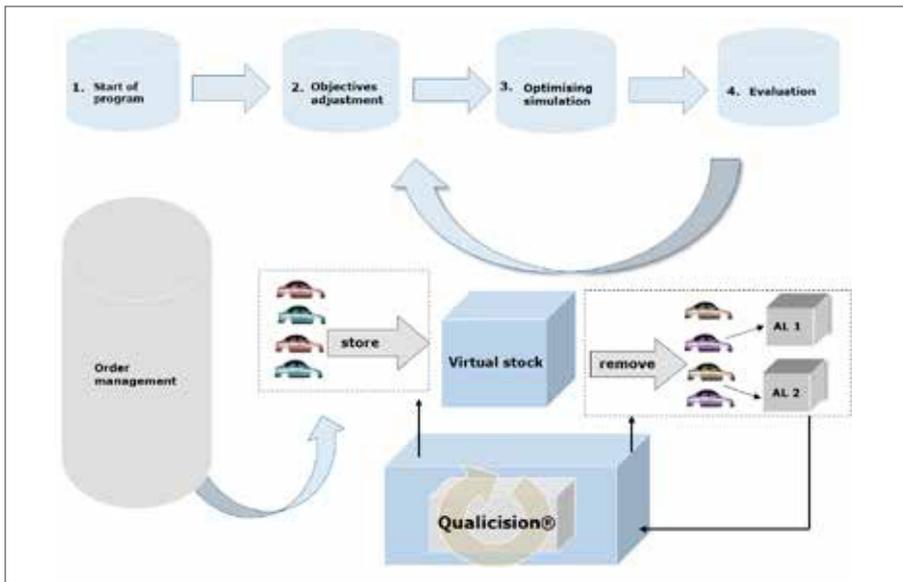


Optimisation flow: Production sequences for body production, paint shop and assembly.

created just a few days ahead of the start of production, in terms of actual production in real time, F/L/S has developed the Qualicision® simulation. This is a tool that helps users to identify the impact of disturbances on a planned sequence and to actively counter them with temporary modifications to the optimisation and sequence specifications. Current inventories and additions to inventory from other production areas or suppliers are used to simulate the production sequences.

to analyse and create future production sequences without directly influencing the online production process. When the program is launched, the orders to be sequenced and the inventory data including additions are imported.

The optimisation specifications are then imported or created by the user. They can be based on technical restrictions, for example that the spacing between two orders involving 6-cylinder diesel engines should be at least four orders (vehicles), or quantity specifications



Simulation process: Using simulation to analyse and create future production sequences.

e.g. “Add 100 orders (vehicles) with all-wheel drive into the sequence”. The user can control the relative

assembly lines based on the optimisation specifications. The interaction between a virtual issue of an order to an assembly

Analysis of process KPIs graphic). The conflict and compatibility analysis (see CC analysis graphic) is a key tool for analysing the sequences created for the individual assembly lines.

The conflict and compatibility analysis indicates which optimisation specifications are in conflict with one another (cells shaded red) and are very difficult or impossible to meet. In the next step, the user can adjust the optimisation specifications to create a better, more homogeneous sequence. Once the optimisation specifications have been adjusted based on the conflict and compatibility analysis, the simulation is restarted.

This step is repeated until the required KPIs are achieved (see Simulation process graphic, step 4). The result of the simulation is that optimisation specifications are determined that take into account the current inventory situation, compensate for any disturbances as far as possible and achieve the desired process KPIs. These optimisation specifications are then transferred to the simulation in the productive system, so that stable, harmonised production can be achieved.

Strategic simulation

Another aspect of the Qualicision® simulation tool is its ability to carry

Name	Type	Min	Nominal	Max	Pts	Rank	S-SC	From	To
3T	Distance	1			100				
3T	EDD%		20		99				
3TS	Distance	1			100		05		
3TS	Distance	5			100				
3TS	EDD%		3		40				
AK	Distance	4			100				
AK	EDD%		7		50				
DS	Distance	1			100				
DS	EDD%		25		88				
MP	Distance	2			100		US		
OS	Distance	1			100		3TS		
OS	Distance	5			100				
OS	EDD%		11		75				
4K	Distance	1			100		US		
4K	Distance	2			100	1			
4K	EDD%		10		55				
RL	Distance	1			100				
RL	EDD%		20		65				

Adjustment of sequence specifications.

importance of the individual optimisation specifications by assigning priorities on a scale of 0 to 100. The simulation can then be performed based on the input data to calculate sequences for one or more assembly lines (AL) (simulation process, step 3). The simulation fills an internal virtual warehouse and issues orders from the virtual warehouse to the virtual

line and a virtual receipt of an additional order results in changes to the currently available inventory, which means that after each individual step the simulation encounters a changed situation and selects the optimum next order for the sequence to be created. Graphical displays show the user the inventory and the utilisation of the assembly lines (see

	6Z	AR	AK	AT	AVS
6Z	-	0.24	0.33	0.19	0.10
AR	0.02	-	0.04	-0.24	-0.23
AK	0.17	0.09	-	-	-0.01
AT	0.08	-0.19	-0.09	-1.00	-0.01
AVS	-0.11	-0.20	-0.09	-0.18	-
4K	0.42	0.46	0.37	0.05	0.25
SL	0.15	0.03	0.13	-0.30	0.12
JVA	0.14	0.22	-0.05	0.16	0.04
GD	0.07	-0.13	-0.02	-0.23	-0.36
MGG	0.22	-0.01	-0.05	0.08	-0.04
RL	0.24	0.27	0.20	-0.03	0.30
US	0.21	0.25	0.16	-0.04	0.05
STH	0.08	0.11	0.25	-0.03	0.01
MOO	0.34	0.30	0.48	0.16	0.25
AVD	-0.44	-0.33	-0.33	-0.37	0.06
Z4	-0.17	-	-	-0.17	0.06

Conflict and compatibility analysis.

out a strategic analysis of production sequences. The strategic analysis enables planned future optimisation settings to be simulated, for example resulting from the start of series production of a new vehicle and the associated technical restrictions. In the results of the conflict and compatibility analysis for the simulation, the optimisation settings that are frequently in conflict are indicated in colour. By analysing this information, the production planner can establish a long-term view of whether appropriate infrastructure measures or additional resources can help to mitigate or eliminate the conflict. The Qualicision® simulation can also be incorporated into a simulation of the flow of materials. For example, a simulation of the flow of materials enhanced with Qualicision® can verify the interaction of non-homogeneous stock location areas (direct access combined with storage lanes) in advance of a physical



Analysis of process KPIs.

implementation. As the optimisation specifications are defined by the user in the Qualicision® simulation, upstream areas such as the paint shop or body production can be incorporated into the simulation for the optimisation calculation. The Qualicision® simulation concept is currently being used to optimise sequences in the automotive industry. However, it can be applied

equally effectively to other production processes. ☉

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