Product report: Technological progress with optimization intelligence

PSIasm Powered by Qualicision

PSIasm/Qualicision is a powerful tool for managing and visualizing multiple resources in chained production processes. An integrated basic scheduling feature allows planning simple workflows. For more complex workflows, the consideration of multi-criteria key performance indicators (KPIs) is essential for planning in the PSIasm basic tool. The integration of Qualicision technology creates added value that combines technological software progress with optimization intelligence.

In a first step, the PSIasm was extended by a Qualicision-based selection of planning scenarios for this purpose. The scenarios are evaluated by KPIs. The calculation of the KPI values is done via Java scripts. The KPIs can be adapted or extended in relation to the customer-specific use case.

This is followed by an evaluation of the calculated KPIs with Qualicision KPI functions (labels). As in other applications, these KPI functions reflect the process-related evaluation knowledge and provide the semantics for the KPIs. In this way, the different planning scenarios can be evaluated by Qualicision.

Optimizing planning scenarios

Depending on the preferences specified by the user, a balanced selection of planning scenarios can be optimized. The selection uses the proven Qualicision KPI Goal Conflict Analysis.

In order to have suitable alternative scenarios available for the multi-criteria selection of a planning scenario, it is obvious to operate with a Qualicision planning algorithm, which itself already considers multi-criteria aspects in the generation of the result via the Qualicision engine.

For this purpose, a Qualicision-based solver was integrated in PSIasm. In the simplest case, the Qualicision solver can initially schedule single-stage operations in sequence, taking into account different qualitative optimization goals such as urgency, importance, compactness and number of alternatives. These Qualicision basic functionalities can be outlined as follows:

- Urgency evaluates how soon an operation must be scheduled in relation to its completion date.
- Importance of an operation is described by the priority assigned to the operation. Operations with high importance/priority are scheduled preferentially.
- Compactness considers rather the already existing schedule and assigns operations preferentially to those work centers that are less utilized than others.
- Number of alternatives considers how many alternative resources an operation can be scheduled on. In this case, an assignment of an operation with less alternatives is preferred to that of an operation with more alternatives.

In the proven manner, the Qualicision solver can be extended by further qualitative optimization goals and is available and usable in a PSIasm version limited to three optimization criteria.

Fully parameterizable Qualicision solver

In the next development stage, another customer-proven and productively used Qualicision solver QFDDS (Qualicision Functional Decision Design Scheduler) will be integrated and made available via PSIasm/Qualicision. QFDDS is a powerful Qualicision solver, which is able to handle multi-level and chained schedules and uses qualitative optimization goals and also knows the concept of optimization.

Both the constraints and the qualitative optimization goals can be configured and extended depending on the use case. QFDDS provides a Qualicision-based, high-performance and extensible optimization and decision solver.

Working with PSIasm/Qualicision

Qualicision functionalities allow several support options for the generation and selection of suitable schedules. Thereby, the usual Gantt visualization of the work results is extended by a few further Qualicision-based information. On the one hand, the optimization KPIs provided for in the Qualicision standard can be set and adjusted via the Goal Function Editor (point 1). The goal conflict matrix visualizes for any given situation, in which degree the optimization KPIs cooperate with the other KPIs (green) or if they need to be optimized using the either/or option (point 2). The ef-

Figure 1: PSIasm/Qualicision with scenario selection, Qualicision scheduling, Goal Conflict Analysis and KPI optimization dashboard including goal achievement diagram and KPI setting functions as well as a Qualicision preference setting with the associated KPI achievement levels.

fects of the optimization potentials can be seen in the goal achievement diagram (point 3).

Depending on the balancing of the KPI preferences (point 4), suitable schedules can be calculated or identified and selected. An example of an alternative scenario (item 5) with the associated settings as well as the solution with the associated work schedule in the form of a Gantt chart (item 6) demonstrates how the functionality mentioned can be used to explore, visualize and optimize the scope for decision-making easily and interactively.

Automatic learning of optimal parameter settings

The use of PSIasm/Qualicision allows the automated generation of planning and decision scenarios, which, by means of the logging of the degrees of goal achievement, provide an optimization history. This is the basis for the future use of machine learning methods, for which the Qualicision learning algorithm F9118 is available. F9118 is able to map the respective data situations (order data, deadlines, capacities, utilization levels, set-up times, etc.) to the schedules in such a way that PSIasm/Qualicision continuously learns the desired process behavior automatically from the interactions with the user and proposes preference settings that are optimally matched and parameterized to the current data situation.

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