



## HOPL

### Heuristic Optimization in Production and Logistics

Programme: COMET – Competence Centers for Excellent Technologies

Programme line: K-Projects

COMET subproject, duration and type of project:

Warehouse Optimization, [05/2014 – 04/2017], multi-firm

### An optimization network for solving complex production processes

The steel production process is a very complex task, consisting of several various but related production stages. When optimizing single phases of the process, the overall target is often disregarded. The aim of this project is to optimize the single stages of the production process within the frame of a network in order to improve the efficiency of the whole process. With this end in mind, HOPL focused on the initial stage of the process in the first year of the project. An integrated optimization method shall support decision makers regarding complex logistic processes. More capacity available shall contribute to an improvement of the products quality.

#### The starting point of each process: high potential of optimization

One major aim of the HOPL project is the optimization of complex production and logistics processes as a whole by integrating various but related sub-processes. Exemplarily for a complex production process consisting of several interrelated stages is the steel production process of voestalpine Stahl GmbH in Linz. The whole operation consists of several products such as raw material and scrap, steel slabs and steel strips. Due to the bound to high quality standards at voestalpine Stahl GmbH, decisions regarding the handling of the products are very complex. In order to allow an efficiently working process, cooperation between several stages like production, stacking, transport, adjustment, etc. is essential.

At the hot storage area, the starting point of the whole process, decision makers have to face the challenge of performing several but conflicting targets. On the one hand the transport calls for assorted lots to reduce the transport route.

Further its capacity shall be utilised entirely. On the other hand it is essential to not exploit the area in order to allow an arranging and stacking process. Due to this, it might happen that a transport vehicle is underemployed.

Based on the complexity and the relevance of the hot storage area to the whole production process, the HOPL project focused on optimizing proceedings in this area in the first year.



Fig. 1: Assorted stacks of steel slabs in the hot storage area of voestalpine Stahl GmbH



### Developed solution by HOPL: an optimization network

In the course of the whole project, an optimization of the steel production process shall be developed. For that purpose the process as a whole shall be split into several sub-problems. The modelling of those sub-problems shall contribute to a complex optimization network representing the steel production process as a whole.

Involved research partners could already achieve important results regarding the hot storage area. An optimization network of autonomous but related sub-problems has been developed in order to improve the efficiency of this area.

The modelling is based on the structure of a so called master-problem and several sub-problems. The master problem does not only link all sub-problems, it also allows the exchange of shared parameters and solutions and hence a collaborative solving. The sub-problems are solved by using customized algorithms that are best suitable for each sub-problem. Hence we have to face the challenge of identifying possibly sub-optimal solutions for the sub-problems, which contribute to a best possible solution for the process as a whole.

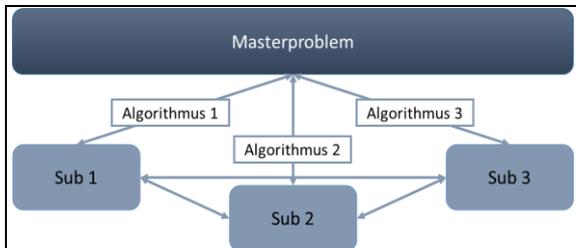


Fig. 2: Schematic description of the modelling structure

Preliminary results were already presented to experts at an international conference. At eurocast 2015 results on linking various algorithms as well as experimental results on solving related sub-problems were discussed. Since regarding networks of optimization problems not much research work has been done, the international exchange is essential in order to tap the full innovative potential of the proposed method.



### Impact and effects

voestalpine Stahl GmbH is integrating the modelled sub-problems into their existing software system awaiting an improvement of the efficiency regarding the proceedings in the hot storage area. An optimized strategy would have a significant positive impact on the utilization of the transport, hence again on the efficiency of the whole process.

Considering research work, the modelling of an optimization network being composed of several interrelated sub-problems and the development of generic algorithms for that, would be of high innovative value. So far the research community focused on decomposing complex optimization problems, whereas the HOPL project addresses the composing of autonomous but related problems in order to allow an exchange of relevant information.

For practical work the achieved results are also of high value as many production processes are composed of several, various but interrelated stages. In such a case the proposed method will be applicable to contribute to a significant improvement of the efficiency of the whole production process.

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