Case Study: Lot-Sizing and Scheduling

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Starting point of the case study is the production planning for a producer of diversely coloured flat glas. The glas is basically melted in a furnace out of the raw materials sand, lime and soda and then brought into the shape in question on production lines, the so-called Feeders. The different colours of the glass are obtained by mixing the raw materials with colour components. The shift from one colour campaign to the next lasts up to 5 days. Within each colour campaign, only products with the joint characteristic basin colour can be made. Besides, a product is identified by the imprinted pattern, the thickness of the glass, the measures as well as the way of packing. Each change of product causes an individual preparation time.

The production structure is based on a two-level production process. Each of the two levels requires the solution of the lot size and sequence planning. The aim is to minimize the preparation times and the inventory levels. Practically, with 500 products and 3 colour campaigns, it is quite unrealistic to perform production planning for campaigns and products at the same time. The hierarchical approach chosen structures the problem into a medium-term campaign planning and a short-term product planning.

In this case study, the upper level of the hierarchical approach is introduced. The level below together with the product planning following afterwards is taken into account by aggregated production coefficients.

For the upper level we tested three approaches. We started with a general Mixed-Integer Program that took into account change-over times. For the time horizon of 52 weeks, the implemented Branch & Bound runs longer than 24 hours.

We than moved to an Integer Model with change-over cost by a zero switch rule, which means if we produce one product in one week we produce it during the whole week. We solved the problem by using the approach of A. Gascon and R.C [2]. Leachman which we extended to deal with change-over cost [4].

In the last approach we reduce the dynamic problem to static one. The solution method used to define the colour campaigns is built up hierarchically. In a first step, the sequences and then the lot sizes are determined. The solution method is based on the procedure by C.M. Delporle and L.J. Thomas [1] [3].

We checked the results of the three approaches against each other. All approaches provided similar solutions in spite of the different assumptions and input parameters.

[1] Delporle, C. M., Thomas, L.J.: "Lot Sizing and Sequencing for n Products on One Facility", *Management Science*, No. 23, S. 1090 - 1079, 1977.

[2] Gascon A., Leachman, R.C.: "A Dynamic Programming Solution to the Dynamic, Multi-Item, Single-Machine Scheduling Problem", *Operations Research*, Vol. 36, No. 1, S. 50 - 55, 1988.

[3] Hauth, M.: "Simultane Losgrößen- und Reihenfolge-Planung für den statischen Fall", Diplomarbeit, Universität Mannheim, 1992.

[4] Kempf, Th.: "Simultane Losgrößen- und Reihenfolge-Planung für den dynamischen Fall", Diplomarbeit, Universität Mannheim, 1992.