TECNOMATIX Plant Simulation SIEMENS

Global Information System of Semiconductor Production
Model Description

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CONTENT

1. Description of the Simulation and Optimization Task

In a GIS (Global Information System) of semiconductor production three factories in Portland, Burghausen and Singapore are managed.

The factories can produce 2 of 3 types of wafers:

Portland: **a** or **b**

Burghausen: **b** or **c**

Singapore: **a** or **c**.

The GIS has a list of customer orders with the desired kinds of wafers, quantities and due dates. The GIS assigns the customer orders to the factories.

The factories produce the wafers and determine ingot costs (ingot is the raw material for the wafers), manufacturing-, warehousing- and transportation costs.

For some orders delivery delays occur, which lead to conventional penalty costs.

1.1 Objective

The optimization task consists in finding

- The sequence of orders
- The assignments of the orders to the factories so that the
  - Sum of delivery delays
  - Total costs

Are as low as possible.

1.2 Tasks

Note that you may minimize either delivery delays or costs. First of all the reduction of costs is realized by avoidance of penalty costs. Both target values have the opposite nature and must be described in a single evaluation function (fitness value). An obvious idea for such multiple target optimizations consists in the calculation of a weighted sum, which connects both goals.

The task is a typical combined optimization with multiple targets:

The optimization task consists in finding the

- Sequence of orders and the
- Assignment of orders to the factories

Such that the sum of delivery delays and the total costs are minimal.

There are additional constraints: Each custom order can only perform on a production line **a**, **b** or **c**. In many practical optimization problems it is very difficult to find valid solutions, which are satisfying all constraints.

1.3 Results

The model leads to an improvement of the transparency of costs and delay in delivery. The model enables you to optimize the distribution of customer orders based on a current list of orders.

Due to the optimization the total costs can be reduced approximately 30%. First of all the reduction of costs is realized by avoidance of penalty costs.

2. Model of the GIS and its Optimization

This model simulates the distribution of the orders to the 3 factories and the processing of the orders. All kinds of costs are determined.

2.1 Demo Instructions

Open the project dialog by clicking the waver icon in the top left corner:

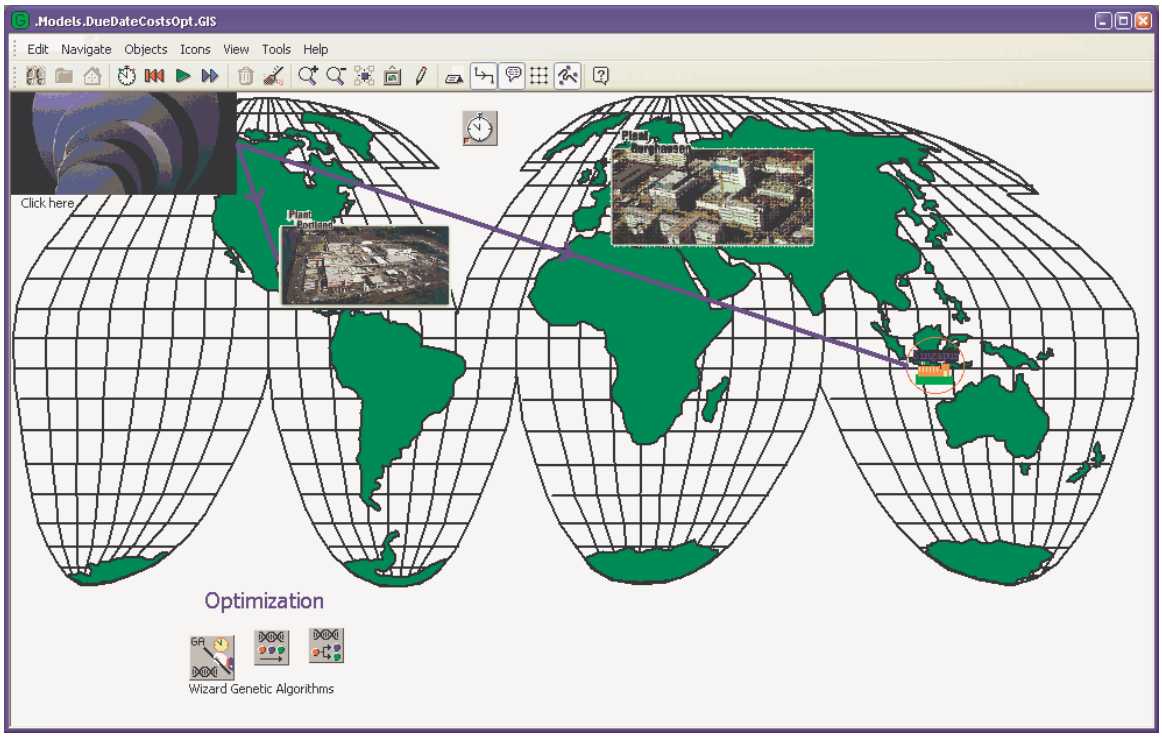

Figure 1: Assignments of the customer orders

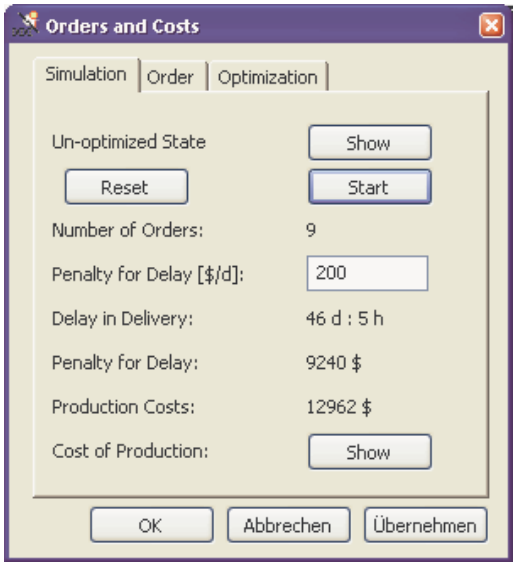

Figure 2: Dialog for showing a short project demonstration

- Click on *Reset* and *Start* in the project dialog to execute a simulation run.
- At first an un-optimized model state is shown by the first tab of the dialog. There are only 9 orders, but the original sequence leads to a large delay in deliveries. Check the cost table under *Cost of Production*. Note the large delay in deliveries of 46 days (see Figure 2).
- Change to the third tab and perform an optimization. As an essential result we obtain a reduction of the delay in deliveries (see Figure 3).

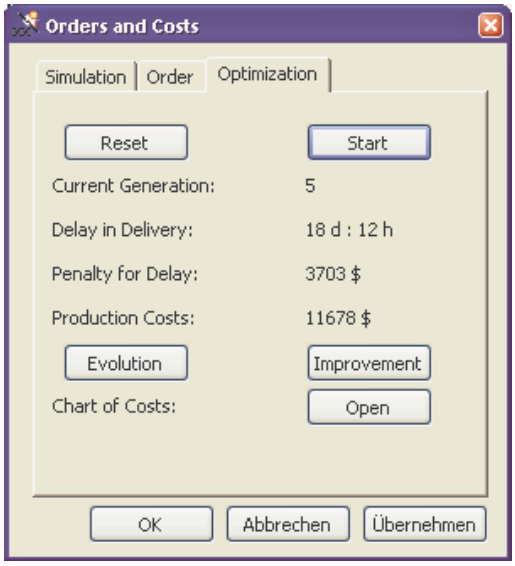

Figure 3: The results of the optimization

- In practice the list of open orders is frequently changed: New orders are entered and

currently open orders are canceled. Therefore a user friendly management of the order list was necessary in the project. For demonstration purpose remove one order and add 2 new orders.

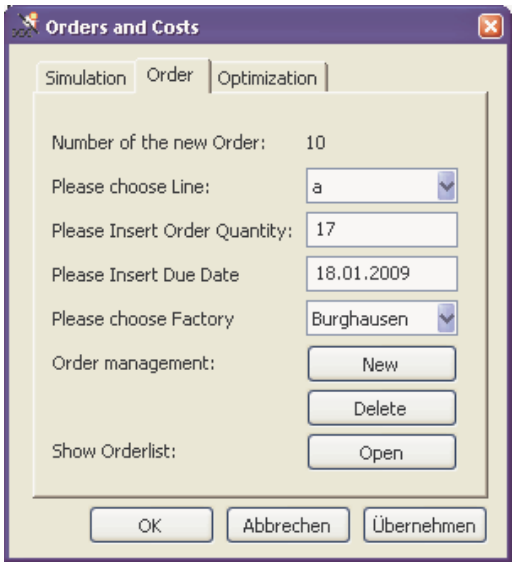

Figure 4: The management of the order list

- Change to the first tab and show the un-optimized state on the basis of the new order list.

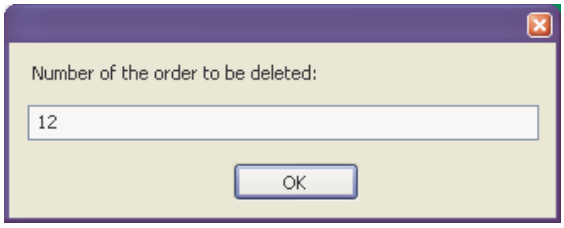

Figure 5: Selection of an order for deletion

- On the third tab an optimization is performed.

After each optimization run the analysis of the costs is shown. The diagram shown in Figure 6 is opened by the button *Improvement*. It will be clear that the avoidance of delays in delivery is the most important way to reduce the total costs.

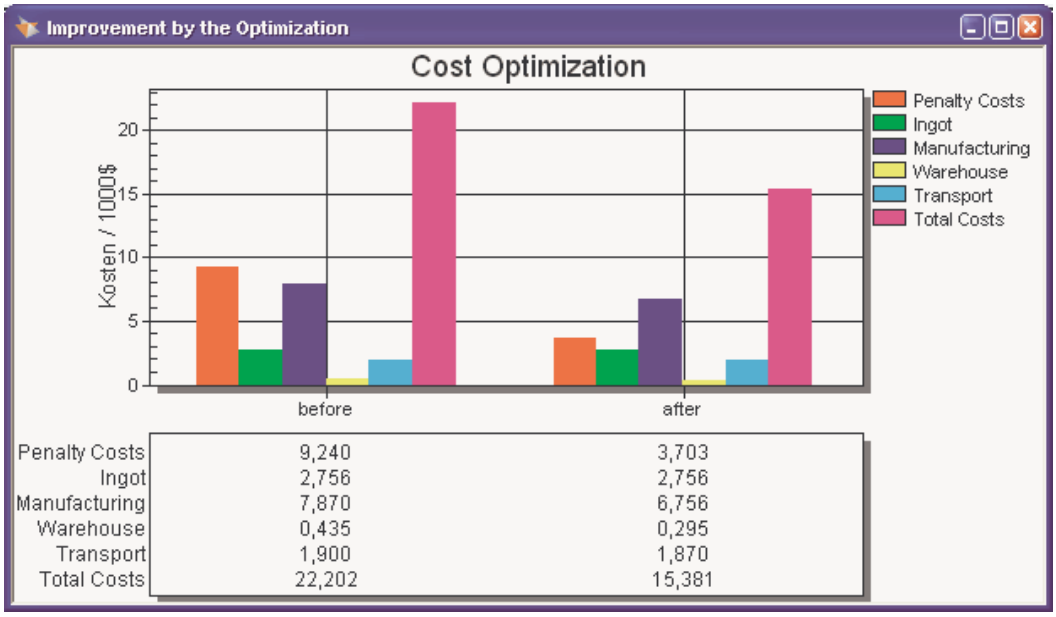

Figure 6: Analysis of the kinds of costs.

2.2 Detailed Description of the Model

Each factory has a similar structure. Therefore the object oriented modeling is very useful. In this approach, we use instances of the same class object *Factory* for all locations. In Figure 7 you see, that each factory consists of 2 different production lines of type **a**, **b** or **c**. The lines which are available in a special factory at one of the locations Portland, Burghausen or Singapore are defined in the table file *Lines*.

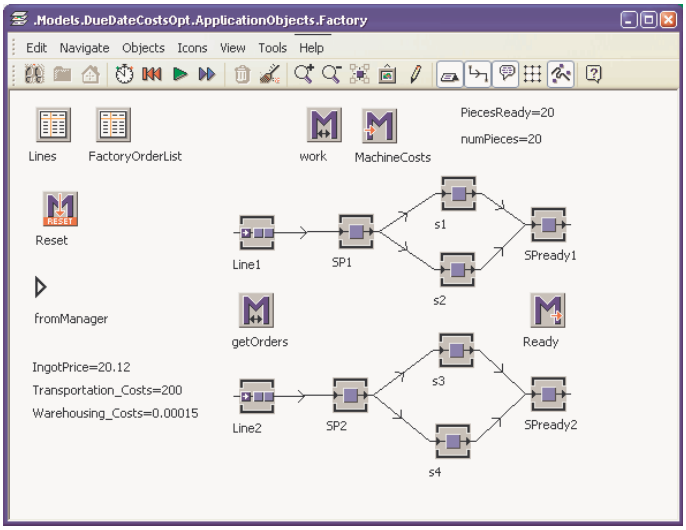

Figure 7: The common structure of the 3 factures is modeled by the class *Factory*.