An Object-oriented Solution of ARGESIM Comparison "C14 Chain Supply" with eM-Plant

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Simulator. eM-Plant (www.emplant.com) is an object oriented discrete simulation tool. It is a system for production, logistics and all kinds of engineering, applied in industries, research and education. Features are: automatic model build-up, virtual reality presentations (real 3Dsolid graphics), online changes, integrated internet access, ActiveX integration.

Model: The Supply Chain Management is modelled using the standard material flow objects. The factories, the distributors and the group of wholesalers are represented by the object "Store" with an infinite capacity. Each factory has an object "Source" that creates the products exponentially. The transport between factories and distributors is modelled by the object "ParallelProc" (work time being supply lead time).

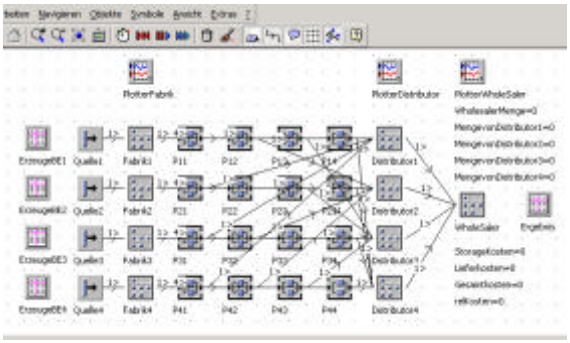

Figure 1: Model layout of the Supply Chain in eM-Plant

The "Event Controller" controls the simulation time of 30 days. After seven days the object "Generator" activates methods which determine the distributors and wholesalers order event according to the supply strategy. For example, when the distributor orders, the method determines the storage of the factory. In case the required amount is available, the products are moved to the distributor (part of code shown below):

```
for zDis:=1 to 4 loop
  for zPro:=1 to 12 loop
  i:=1;
  repeat
  if ((Order[zDis, zPro][1,i].occupied) and
  (Order[zDis, zPro][1,i].content.type=zPro)) then
  Order[zDis, zPro][1,i].transfer(zDis);
  tabDisIni[zDis,zPro]:=tabDisIni[zDis,zPro]+1;
  end;
  i:=i+1;
  until ((TabDisIni[zDis, zPro]>=10) or (i>5000));
  if zDis=1 then supcosts:=
                supcosts+tabcosts[factory, zDis];
  end;   next; next;
```

eM-Plant does not support the experimental design. In order to carry out the needed 100 simulation runs for each tasks a special method has been developed. The results of the simulation runs are evaluated using the DDE interface of eM-Plant. After each simulation run the values are transferred to MS Excel and analysed by standard functions.

Task a: Simple Order Strategy. This strategy leads to an increment in the stock for each distributor as shown in following figure and table.

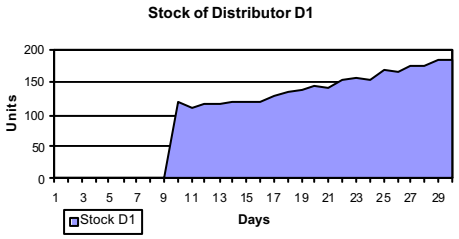

Fig. 2: Stock of Distri-butor D1 (task a)

Task a	min	max	mean	dev
C	27.293 €	34.516 €	31.460 €	1542,19
N	184	246	212	13,12
R	135 €	166 €	148 €	6,46

Task b: On Demand Order Strategy. This modified strategy is implemented as further method in the object "Generator" (as also done for task c). Costs for distributors decrease, while stock stays almost constant (following figure).

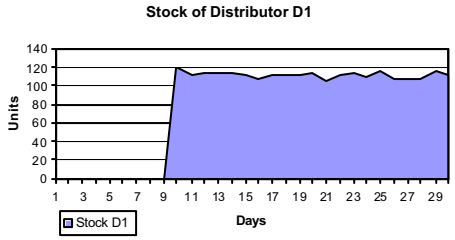

Fig. 3: Stock of Distri-butor D1 (task b)

Task b	min	max	mean	dev
C	27.770 €	33.260 €	30.799 €	1266,05
N	186	246	213	11,82
R	129 €	162 €	145 €	6,02

Task c: Minimal SupplyTime – Strategy. The distributor tries to order from the factory with the minimal supply lead time. This results in a decrease of costs and is the best strategy in comparison with the other strategies.

Task c	min	max	mean	dev
C	22.009 €	27.184 €	24.698 €	1134,88
N	184	246	212	13,12
R	105 €	129 €	117 €	4,94

C14 Classification: Process Flow – Object-oriented Approach

Simulator: eM-Plant, Rel. of 2002