



A Process-oriented Solution of ARGESIM Comparison "C14 Chain Supply" with AutoMod

M. Ciupek, S. Kernbaum; TU Berlin;
markus.ciupek@mf.tu-berlin.de

Simulator. AutoMod, a product of Brooks Automation, can be used in almost any area of manufacturing and material handling. It provides true to scale 3D virtual reality animation, user expert-based material handling templates for Conveyors, Path-based Vehicle Movement, Power & Free, AS/RS, etc. and a general propose template Process System for modelling resources, queues etc. The spreadsheet interface and an English-like simulation language provide flexibility in modelling applications.

Model: The Supply Chain Management is modelled by using the Process System Template. Each element (factories, distributors, wholesaler) is represented by an infinite capacity queue. The different products are modelled with the AutoMod element "loads" which are controlled by the logic of the model.

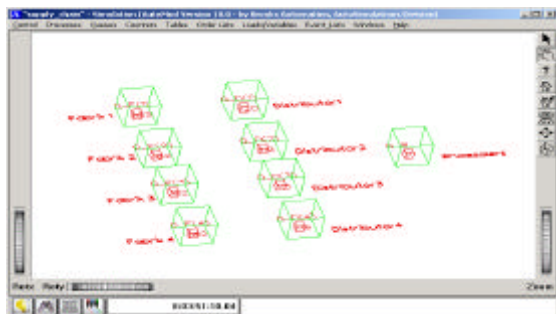


Figure 1: 3D visualisation of the model

The loads arrive in the queues representing the factories (user-defined attributes "product type" and "factory" set). The loads are also waiting in a logical list (order list). In order lists loads are delayed until another load orders them to continue. Rules which are used to order loads satisfying special conditions (e.g. product type) and rules, which are used in case the order is not filled, are possible. Order lists are a simple way to define backorder strategies. Dummy loads are implemented to order the necessary loads from the order lists of the according factories to the distributors. The use of arrays for production plan, supply lead time (all tasks), order strategies (task a, b), back-order and cost matrix give a general algorithm:

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if V_P(zPro,V_Factory)>=V_BO(zPro,zDis) then begin
order V_BO(zPro,zDis) loads satisfying LA_P=zPro
from OL_F(V_Factory) to V_ProcessPtr(zDis)
if V_BO(zPro,zDis)>0 then inc V_Cost(zDis,
V_Factory) by (V_LeadT(zDis,V_Factory)*10)
set V_BO(zPro,zDis) to 0
end
else inc V_BO(zPro,zDis) by V_BO(zPro,zDis)
    
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The algorithm is also used for the order of the wholesaler and with simple modifications for every task. AutoMod includes the module "AutoStat" to perform statistical analyses. AutoMod also provides a component "Business Graphics" to watch values or changes of variables during the simulation run.

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

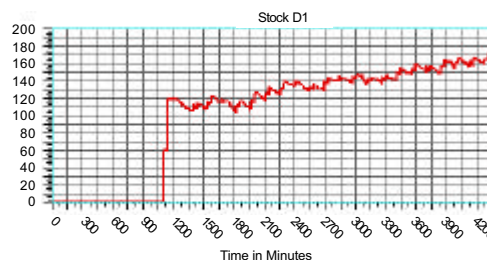


Fig. 2: Stock of Distributor D1 task a

Task a	min	max	mean	dev
C	30.210 €	36.428 €	33.157 €	1372,6
N	189	262	224	14,01
R	134 €	170 €	148 €	6,959

Task b: On Demand Order Strategy. The modified strategies of task b and task c are controlled by the aforementioned "order list". Costs for distributors decrease (mainly at storage costs), while stock stays almost constant (following figure).

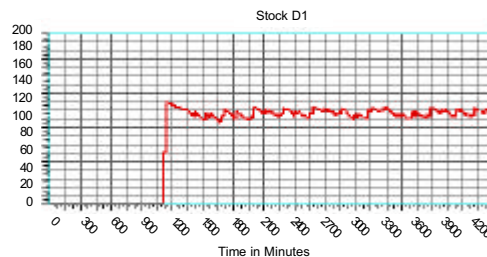


Fig. 3: Stock of Distributor D1 task b

Task b	min	max	mean	dev
C	29.731 €	36.628 €	32.698 €	1452
N	197	260	226	14,12
R	129 €	157 €	144 €	5,82

Task c: Minimal Supply Time – Strategy. The minimal supply lead time leads to a decrease of costs, giving the best results (shown in following table).

Task c	min	max	mean	dev
C	24.126 €	29.268 €	26.364 €	1129,4
N	197	260	226	14,12
R	103 €	129 €	116 €	4,84

C14 Classification: Material / Process Flow – Approach

Simulator: AutoMod, Rel. of 2002

