AUTOMOD 소개

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AutoMod Products and Extensions

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AutoMod technology is an industrial simulation system that combines CAD-like drawing capabilities with a powerful, engineering oriented language to define control logic and material flow. The result is the portrayal of a manufacturing system in accurate, 3 dimensional detail. AutoMod's CAD features are used to define the physical layout of manufacturing, material handling, and distribution systems. Unlike most other simulation languages, AutoMod's powerful graphical interface accurately captures the physical constraints of distance, size, and space in 3-D.

AutoMod also provides the user with a set of "expert based" movement systems that have been developed from AutoSimulations Inc.'s (ASI) real-world experience in industrial automation. As a result, a substantial portion of the underlying model logic is generated for the user automatically from the graphics and the movement system input parameters. Furthermore, the 3-D animation is an automatic part of model development.

AutoMod MODEL DEVELOPMENT ENVIRONMENT

AutoMod differs significantly from other simulation systems because of its ability to deal with the physical elements of a system in physical (graphical) terms and the logical elements of a system in logical terms. AutoMod also offers advanced features to allow users to simulate complex movement (kinematics and velocity) of equipment such as robots, machine tools, transfer lines, and special machinery. All graphics are represented in three-dimensional space with unlimited viewing control including: translation, rotation, scale, light-sourced solids, perspective, and continuous motion viewing.

AutoMod is really two programs. The build portion is for the physical and logical model definition. After the user has defined the physical and logical components of the model, it is then compiled into an executable model, where the simulation and animation run concurrently. The executable model is fully interactive, it can be stopped at any instant in simulated time to view statistics and model status.

An AutoMod model consists of one or more systems. A system can either be a process system, in which control logic is defined, or a movement system. Each model must contain one process system and any number of movement systems. AutoMod loads are units of traffic that move between processes in the process system. Processes can contain complex logic to control the flow of either manufacturing materials or control messages, contend for resources, are modified, and then leave. Loads can move between processes with or without the use of movement systems. Normally, loads that use movement systems represent manufacturing materials that move directly from one process to another. Loads that do not use movement systems are usually control signals or logical messages.

Loads that flow through the process logic have the ability to claim and release resources, enter and leave queues, be added and removed from order lists, change the value of variables, counters, and load attributes, create a new load or kill an existing load, read from and write to external files, and determine the next process. All interarrival and event times can be represented by deterministic

values or be derived from a random number from one of several included statistical distributions.

USER INTERFACE

AutoMod's user interface is window oriented, utilizing pop-up or pull-down menus, dialog boxes, selection lists, and a high performance mouse based editor for developing process procedures. AutoMod uses a three-button mouse, while AM2e uses a 1 button mouse and controls keys. The right button activates the pop-up menus, the center button is used for selecting or choosing options, and the left button is for zooming and controlling graphics view positions.

SUMMARY

AutoMod is a industrial oriented simulation system that provides the ability to define the physical elements of a system using CAD-like graphics and to define the logical portion of the system using a powerful procedural language. The results are that a typical user can befrom 3 to 10 times more productive using AutoMod in comparison to using any other simulation language. The accuracy and degree of detail with respect to movement systems is unapproached.

AutoMod allows the construction of very large, complex models. In fact, AutoMod's structured language has proven that the larger the project, the more benefits AutoMod has over its competition.

AutoMod provides real three-dimensional graphic animation. There are no limits to the views or the size of the picture to be shown. The degree of animation realism is also unmatched as AutoMod provides light-sourced solid graphics with Z depth sorting, so all entities are shown in the correct relation to one another on the screen.

Other ASI Products

AutoSched

AutoSimulations is not new to production scheduling. InterFaSE, a finite capacity scheduling product, was developed in 1985 and installed in various industries in several different functional configurations. Although InterFaSE is no longer being marketed, it is still in use. AutoSimulations learned two important lessons when developing this product. First, there is a significant overlap between simulation and scheduling and a product that could bridge the two would be invaluable; and second, there are various, unique situations that make it difficult to apply a single, rigid scheduling approach. AutoSched, with AutoMod as a foundation, provides a solution to both of these.

AutoSched contains a library of scheduling tools. The term 'library' means it is a group of AutoMod procedures, subroutines and functions. When this library is used with AutoMod, it provides a powerful, fully featured, finite capacity planning and scheduling system. With AutoSched, model building is simply a matter of providing the definition of the factory, products and desired production requirements in data files and furnishing a set of rules for operating the factory in familiar, manufacturing terminology. The input data may be collected from existing data bases or spread sheets, or be created specifically for AutoSched.

AutoSched visualizes the world as a number of stations where work is performed: a machine, work bench, assembly position, etc.. Each station has a calendar associated with it that specifies when it is available to perform work. These calendars consider shifts, holidays, maintenance schedules, and other real-life situations. And every station belongs to a family, even if the family contains only a single station.

Stations in a family share a common input queue and work list for parts waiting for service. Parts flow between the stations in a sequence which is determined by the part's routing or process plan. A process plan consists of an arbitrary number of steps indicating the family, setup, time required and operator class, among many other parameters.

Parts can start at the first step of their process plan or at their current step if they are already in process by entering the family work list and queue for the designated family. Idle stations in the family, which are on shift, wake up one at a time and execute the task selection rule with the particular station to pick a part from among all of the potential parts, or to wait for a better choice. Operators, tools, components and many other constraints can be considered in task selection.

The schedule file is updated as parts move through their process plans, indicating the order and simulated time at which the operations take place. In addition, factory performance statistics are being collected that indicate the efficiency that can be expected if operated per AutoSched's schedule.

AutoSched can be used in two modes: Periodic Scheduling and Real Time Dispatching. Periodic Scheduling implies developing a finite capacity schedule from an accurate status of the shop floor which is then provided to the shop floor for implementation. One fundamental problem with pre-planned schedules is if an unforeseen event occurs in the real world that wasn't considered in the original schedule, a new schedule must be created and given to the shop floor. If the rate of unforeseen events is excessive, Periodic Scheduling becomes cumbersome and time consuming.

Real Time Dispatching, on the other hand, allows the simulation to run parallel with real time. This method requires the model to receive detailed messages from the shop floor control system as the appropriate events occur on the shop floor. These events are actual events rather than simulated events. The model updates the status of the internal data structures as the event messages are received, and in turn sends a message back to the shop floor system specifying the next job to be done. The model will react accordingly and schedule the factory efficiently, even in a dynamic environment. However, Real Time Dispatching , with all its capabilities, still requires capacity analysis.

In summary, each type of scheduling has its pros and cons, and each customer must decide which is best for them. AutoSimulations' AutoSched helps alleviate some of this decision process by providing the capability to do both.

Plotter Extension

ASI offers an additional module that allows the user to output the graphical image of an AutoMod model into HP-GL (Hewlett Packard's Graph Language, which is a fairly common standard among plotter devices) or PostScript commands; these commands are written to a data file and can be sent to a plotter or laser printer that is either directly connected to the computer, or is connected through a network. The plotter module is fully integrated within AutoMod. The user is provided with an icon that is displayed in the title bar of the Work Area window of AutoMod's builder and in the Work Area window of a users model. Using AutoMod's standard view control features, the user positions the model display in the orientation in which the model is to be plotted. The user then selects the plotter icon with the mouse, and two windows are displayed: The Plotter Control Window and the Plotter Preview Window.

The Plotter Control Window allows the user to select the plotter type that the draw commands will be generated for, the paper size of the plot, the scale of the plot, the pen colors (if using a plotter), if a border is to be generated, etc.. As the control parameters are defined, the user is able to preview the result by observing the Plotter Preview Window.

Once satisfied, the plot file is generated and sent to the appropriate plotter or printer device by selecting buttons in the Control Window.

ASI currently supports black and white or color PostScript printers, as well as the following Hewlett Packard (HP) plotters:

HP DraftMaster I
HP DraftMaster II
HP DraftPro DXL
HP DraftPro EXL
HP DraftPro
HP 7550
HP 7475

If your company has a plotter that is not listed above, but supports HPGL, ASI would be happy to send you an example command file to test with your plotter.

Having a hard copy is particularly useful in building large and complex models. ASI's consulting division frequently sends drawings to customers to verify layouts. It is particularly useful in the process of modeling complex material handling systems where numerous connections are required between AutoMod's process system and the appropriate movement systems.

The Kinematics Extension

AutoSimulations' Kinematics Extension is an enhancement that animates any device that has motion, and integrates it directly into an AutoMod model. If a robot, forklift or process machine is part of a real-world system, it can become an integral part of an AutoMod model. Using ACE, AutoMod's built-in shape generator, a user can define three dimensional components and can inter-connect them with joints—either rotational or translational. These joints allow a user to create machines that have vertical traverses (movement up and down), radial traverses (movement in and out), rotational traverses (circular movement), as well as linear traverses (movement along a track). A joint (motion axis) is defined by its joint speed, motion limits (how far can the rotational joint pivot) and other dynamic parameters. Kinematics enhances AutoMod's accuracy by allowing an additional level of detail to be animated -- machines will move at the same speeds and with the same motions in the model as they do in the real world.

The Kinematic movement system enhances the power and flexibility of AutoMod by adding the ability to simulate cell-level, detailed machine tasks. Kinematics can also enhance other movement systems. For example, an AGV can be built that has a multi-axis robot arm on the pay-load deck. The robot arm and the AGV can be synchronized so that the AGV correctly positions itself, the robot arm reaches out and picks up a load off of the dock, the robot arm retracts, and then the AGV takes off for its destination.

When Kinematics is combined with ACE, communication between engineers, management and production is dramatically improved. Robots and machines are easily recognized; they look and move just as they do in the real world. This makes Kinematics an important feature in models that will be used in design meetings and presentations.

IGES/Sim Extension

AutoSimulations' IGES/Sim utility allows the transfer of design files from various CAD systems to AutoMod. The transfer process is easy. Simply direct the CAD system to convert its files to an IGES (Initial Graphics Exchange Standard) format. IGES/Sim reads the IGES files and displays the contents graphically. The user is then able to identify each element of the graphic model and write the data to an AutoMod format. A line from a CAD file can be defined in AutoMod as a conveyor section, a guidepath segment, or a facility aisle or column.

IGES/Sim eliminates the need to produce drawings and layouts twice. In a fraction of the time it would take to duplicate drawings, design files are transferred between a CAD system and AutoMod. IGES/Sim helps turn static CAD drawings into dynamic 3-dimensional animations.

AutoView is a utility intended to re-create model animation according to the modeler's unique plan. AutoView allows the modeler to restart the animation and to move back and forth in time and space. Animations are created using test files read in from the AutoMod simulation and *.cell* files created or adapted in ACE. By editing the ASCII-format text files, an animated "film" can be created from the model, complete with dynamic "camera shots" that follow a user-defined script. AutoView's camera can follow loads or vehicles around a facility, or can move about, offering a global view of operations.

AutoView is a must when model graphic displays are required. AutoView offers even more graphic options than AutoMod without the logical and statistical processes that can slow response time.

AutoStat

AutoStat is a separate utility to AutoMod that provides enhanced statistical analysis capability. Certain simulation models must "warm-up." The "warm-up" period is determined when various functions of the model are reaching a steady state. Statistics should only be collected after achieving warm-up. In the past, simulation practitioners either had to make an educated guess, or complete difficult calculations to find the warm-up period. With AutoStat, a simple menu selection provides warm-up information. AutoStat also provides a time-line graph depicting the actual warm-up curve. This curve includes model fluctuations over time.

With AutoStat you can make several consecutive simulation runs without intervention. Simply name and define each run by entering the desired snapshots, the variables to be changed between runs, or a range of variable changes.

AutoStat also calculates minimums, maximums and confidence intervals for user selected AutoMod statistics.

Another important feature of AutoStat is its "Design of Experiments" (DOE) environment. If you're familiar with DOE, you'll immediately recognize the powerful benefits of this statistical tool. DOE is a statistical method for deciding which model factors (or variables) are significant, thereby reducing the number of runs required to fully examine alternatives. AutoStat's DOE environment is simple to use. First, define a model's important performance statistics (responses), and the attributes you wish to experiment with (factors). Then define the range over which each factor is to be varied (factor configurations). Finally, execute the desired runs. AutoStat returns to the user confidence interval charts to vividly show you how varying each factor affects the model's responses. Interactions between factors are also shown. You'll know which variables to continue experimenting with, and which variables are insignificant in the model's final performance.

AutoStat means greater statistical power and enhanced model analysis and understanding. It also means more time for other tasks and less time consumed by the drudgery of statistics.

UniFit II

UniFit II was designed to automatically and accurately determine the best probability distribution for observed data. UniFit II's secondary goal was to provide assistance in modeling a source of system randomness in the absence of data. This allows UniFit II to select distributions for specifics such as machine downtimes.

UniFit II helps avoid serious modeling errors that could cause erroneous results and costly decisions. And, best of all, a typical UniFit II analysis takes less than five minutes.

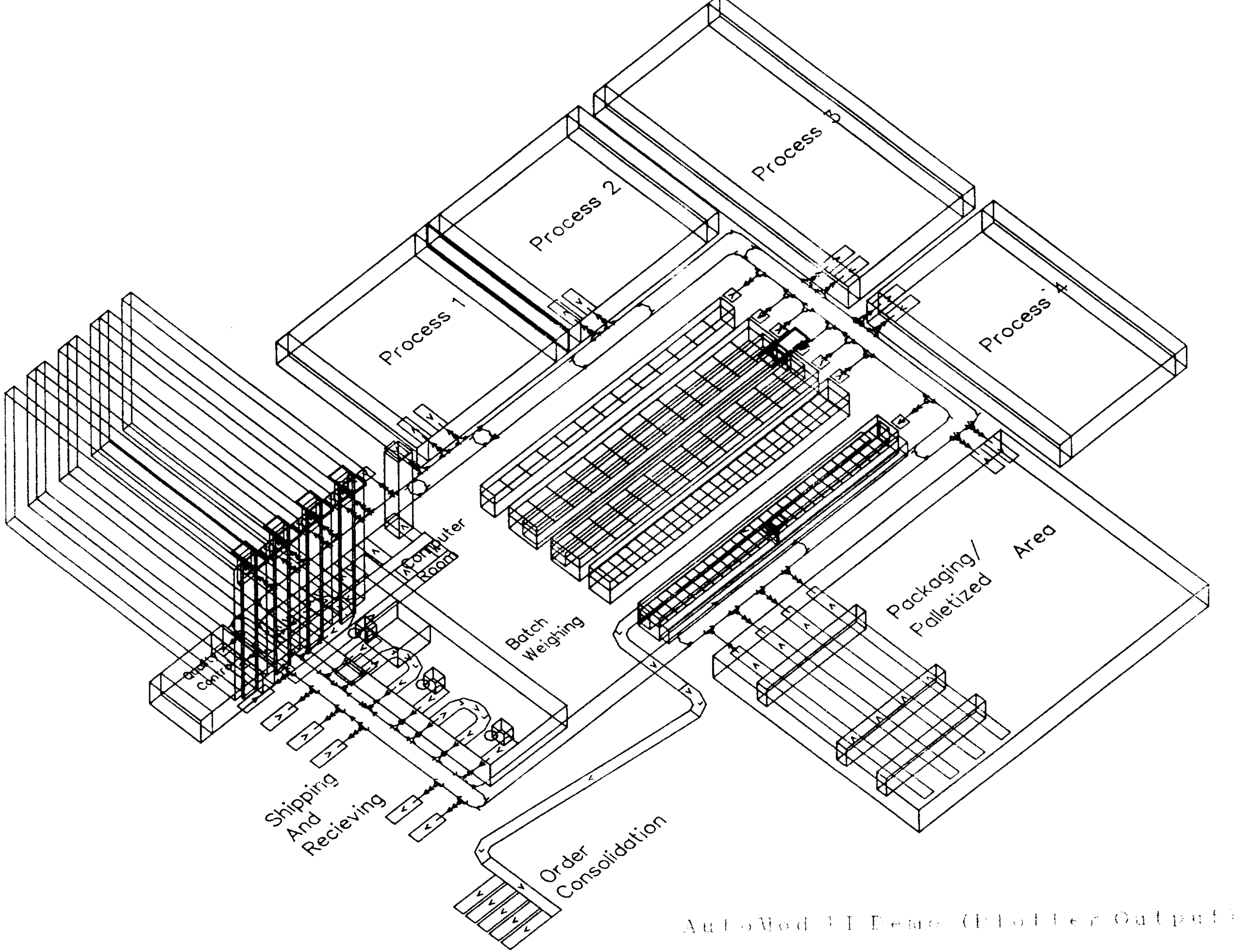
UniFit II has a very extensive and comprehensive on-line help system that explains every available menu and result screen.

Empirical distributions can be constructed from system data and put into the proper format for direct input into AutoMod.

UniFit II is also able to read data from ASCII data files. Values can be placed one value per line or multiple values can be placed on one line if they are separated by blanks and/or commas.

UniFit II produces both text and graphical outputs on the screen, and both can be printed or exported as well. The exported text and graphics can then be imported into word processing and "paint" programs.

AutoSimulations is an authorized distributor for the UniFit II software application. UniFit II is a registered trademark of Select Software Services, an Averill Law & Associates affiliate.



AutoMod II Demo (Plotter Output)