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TAYLOR ENTERPRISE DYNAMICS

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ABSTRACT

Taylor Enterprise Dynamics (Taylor ED) is an object-oriented software system used to model, simulate, visualize, and monitor dynamic-flow process activities and systems. Atoms are Taylor ED's smart objects and model building resources. In addition to Taylor ED's standard atom libraries, users can create new atoms themselves. Taylor ED's object-oriented architecture provides users with the ability to enhance and increase the functionality of the Taylor ED software system. It also provides simulation experts with a platform on which to create new simulation software programs for specific industries or for specific applications. Historically, Taylor ED has been used to model manufacturing, warehousing, and material handling processes. The software is being used more and more to model, simulate, and visualize service and data flow processes. In addition to these traditional uses, Taylor ED is also used to monitor flow processes in real-time. This paper briefly describes the uses and benefits of Taylor ED.

1 TAYLOR ED – MODELING, SIMULATING, VISUALIZING, AND MONITORING DYNAMIC FLOW SYSTEMS

Information and knowledge are the thermonuclear competitive weapons of our time. Knowledge is more valuable and more powerful than natural resources, big factories, or fat bankrolls. Success will come to organizations that have the best information or wield it most effectively (Stewart 1997).

As a result, companies are spending more time and resources to generate and capture information and knowledge about their dynamic-flow systems. By "dynamic-flow" we mean the discrete flow of products, people, data, paper, or information through a system. Examples of such a flow include automobile bumpers flowing through a paint line, orders being picked at a distribution center, electronic data flowing through an information network, or the flow of people through an amusement park ride.

The two major challenges to gaining knowledge about dynamic-flow systems are complexity and uncertainty. With an increasing number of components in a system, it becomes more and more difficult to understand the system or to describe the relationship of the components in the system mathematically. Moreover, when uncertainty is introduced to the same system (machines breaking down, varying cycle times, changes in batch sizes, or the sickness of a key employee) most analytical methods fail.

For dynamic-flow systems characterized by complexity and uncertainty, Taylor ED can be a powerful tool to gaining insight and knowledge about the system. When – and only when – the relationship of a system's components are understood can the system be improved.

Using Taylor ED to gain insight and knowledge about complex and uncertain systems usually starts with building a model.

2 BUILDING A MODEL IN TAYLOR ED

Creating a model layout is the first step to building a model. To create a layout, the modeler selects, drags, and drops atoms from the atom library onto the screen. The atoms can be sized and located on the screen with the mouse. Taylor ED users have over 170 atoms to choose from when building models, and new atoms are available monthly to download at taylor-ed.com. Selecting which atoms to use depends on how closely the atom's functionality mimics the real-world resource it is supposed to represent. If no atoms in the library accurately represent the real-life resource, a new one can be created using Taylor ED's Atom Editor. Customization of model building resources and the software's interface are two characteristics that distinguish Taylor ED within the discrete-event simulation market. In essence, this feature allows the user the expand the software's capabilities and functionality.

Once a model is created, the next step is to connect the atoms and define the routing of products or entities (also atoms) flowing through the model. This is accomplished by attaching atoms through channels. Each atom may have multiple input channels and output channels. Routing is defined when the output channels of atoms are connected to the input channels of other atoms. Additional complex routing logic can be assigned to each atom through the use of Taylor ED's pull-down menu in the atom's "Send To", "Receive From", or "Trigger" fields.

The second step to model building in Taylor ED is to assign logic to each of the model's atoms. In this step, the modeler edits the parameter fields of each atom and, in so doing, defines the behavior and functionality of each object-resource. The editing windows are opened by clicking on the atom in the layout. Right and left mouse clicks can open separate editing windows.

3 TAYLOR ED'S ATOMIC CONCEPT

As noted, Taylor ED is founded upon the "Atom Concept." An atom is an object with four dimensions (x,y,z, and time). Each atom can have a location, speed, and rotation (in x,y, and z) and dynamic behavior over time. Atoms can inherit their behavior from other atoms, atoms can contain other atoms, atoms can be created, atoms can be destroyed, and atoms can be moved into one another. Atoms can be viewed dynamically and simultaneously in 2D, 3D, and Virtual Reality (VR) animation. In fact, everything in Taylor ED is an atom, whether it is a resource, a product, a model, a table, a report, a graph, a record, a library, or even an application itself. The atom concept has created a system that is powerful, flexible, and easy-to-use because atoms are built to function as precisely as the real-life system, part, person, machine, or ASRS system they represent.

One of the hallmark characteristics of the atom is that once they are created they can be reused over and over again. Atoms are "reusable." For example, a workcell can be created "from scratch" using the Atom Editor or by combining several existing atoms. If the workcell is to be duplicated or used in future models, the workcell can be saved as an atom and included in a standard atom library. Not only can atoms be reused but atoms can be shared with other Taylor ED modelers.

4 MULTIPLE RUNS, RESULTS, AND LINKS TO EXTERNAL SOFTWARE PROGRAMS

Once a model is created and logic is assigned to the atoms, the modeler can begin to simulate the model by running conditional scenarios in condensed time. Taylor ED will capture and compare the data generated from each run. In addition to single runs, the modeler can define multiple runs and, if wanted, multiple scenarios. Taylor ED includes both an experiment module and an OptQuest Optimizer, which allow users to define the conditions, variables and constraints to be tested, the number of times each condition is to be run, the length of each run, and the performance measure(s) against which the results of each scenario can be compared or optimized.

Results from each simulation run can be viewed dynamically in 2D, 3D, and VR animation while the model is running. Taylor ED's animation includes a mouse navigator that allows the modeler to view multiple windows of the same model simultaneously, to pan through each model, to zoom in and out of the model, and to rotate the view angle of each model while in 3D. In addition, a special mode allows users to "flythrough" their models using the mouse. All of these model view manipulations can be done without influencing the run-speed of the model.

In addition to the model's animation, results of each of the model's runs can be viewed through accessing predefined reports, user-defined reports, predefined graphs, and user defined graphs. Results may also be exported to external software programs through DDE, DLL, ODBC, SQL, or Windows Sockets connections.

Historically, the lifecycle of a simulation model was as follows: a model was created of a real-life system, simulation scenarios were run, an analysis of the results was conducted, and, depending on the results, changes were made to the real-life system. At this point the modeler moved on to the next simulation project and the lifecycle of a new model was begun again. All a modeler could bring forward from one model to the next was the knowledge gained on how to build models.

As previously described, the hallmark characteristics of Taylor ED are that atoms can be created, they can be reused, and they can be shared. This characteristic is one of the ways in which Taylor ED extends the lifecycle and increases usefulness of simulation projects and models. Another important Taylor ED feature that extends the lifecycle and increase usefulness of simulation projects and models is Taylor ED's ability to monitor real-time flow systems.

Taylor ED monitors real-time systems by linking to external programs to read and write information through DDE, DLL, ODBC, SQL, or Windows Sockets connections. For most simulation and analysis purposes, data transferred to and from Taylor ED is run in condensed time, meaning the model is running years worth of time and data in only seconds or minutes of actual time. However, Taylor ED can also synchronize the run with real-time. With the ability to connect to external systems, such as real-time databases, ERP systems, and warehouse management systems, real-time information can be fed to a Taylor ED model and used to monitor (or even control) the system in real-time.

5 SUMMARY

Taylor ED is an object-oriented software system used to model, simulate, visualize, and monitor dynamic-flow process activities. The software system is based on the "Atomic Concept." Atoms are Taylor ED's smart-object resources used to build, simulate, visualize and monitor models. The atom concept allows users to create new atoms, and thus, actually expand the software's functionality. Taylor ED's atom editor can also be used to create completely new simulation software programs for specific industries or for specific applications.

The atom concept makes model building and analysis easier and more powerful. The atom concept also increases the value and lifecycle of models because atoms are reusable and the models can be used on an operational basis for either defining or for monitoring real systems.

Organizations who (1) build models, (2) simulate models, (3) visualize the relationships of the model's components, and (4) monitor real-time processes will generate greater insight and knowledge about their complex and uncertain systems – and success will come to organizations that have the best information and wield it most effectively.

REFERENCE

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AUTHOR BIOGRAPHY

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