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INTRODUCTION TO SIMAN/CINEMA

Mark A. Glavach
David T. Sturrock

Systems Modeling Corporation
504 Beaver Street
Sewickley, Pennsylvania 15143, U.S.A.

ABSTRACT

SIMAN/Cinema V is a general-purpose simulation language and animation system designed to model discrete event, continuous, and combined discrete/ continuous systems.

This paper presents an overview of the SIMAN/Cinema V modeling capabilities and describes some of the recent enhancements to the software.

1 INTRODUCTION

The SIMAN language (Pegden 1982) is a general-purpose SIMulation ANalysis program used to model complex systems. Accompanying SIMAN is Cinema (Systems Modeling 1985), a flexible animation module used to design and run realistic graphical depictions of a SIMAN model.

Although many applications of SIMAN/Cinema have been in the manufacturing arena, its use has spread to a wide range of other industries including banking, computer, electronics, food service, health care, process, and transportation. In addition, each year introductory and advanced SIMAN/Cinema courses are taught at 300-400 colleges and universities throughout the United States and abroad.

Much of the popularity of SIMAN/Cinema comes from its continual improvement since the introduction of SIMAN in 1982. With its latest release, SIMAN/Cinema V (along with its tightly integrated family of products) retains its position as the technological leader among simulation software.

2 CAPABILITIES OF SIMAN/CINEMA V

Banks (1991) presents many features that are essential to a simulation product for use in the manufacturing industry, many of which are equally desirable for a simulation product used to model numerous other types of complex systems. These features (along with several others) have been summarized in the following sections as Input, Modeling, Execution, Output, and Animation.

2.1 Input Capabilities

Input Data Analysis: The SIMAN Input Processor module gives users the ability to read raw input data, automatically (or manually) select an appropriate probability distribution, and determine the distribution's defining parameters.

Model Input Flexibility: Model data may be input either interactively or in batch mode. This may be accomplished via both customized user menus and a wide variety of disk file formats including formatted, unformatted, sequential, direct-access, and worksheet files. Formats may now be specified using either FORTRAN or C conventions.

2.2 Modeling Capabilities

These are classified below in terms of the software's ease-of-use, built-in flexibility, and special-purpose constructs.

2.2.1 Ease-of-Use

Graphical User Interface: SIMAN/Cinema has its own object-oriented, graphical user interface with which users may build models in a windowing environment through the use of icons and dialog boxes. This interface is identical regardless of the platform or operating system on which it is run. Models may be built rapidly by selecting graphic icons, placing them on the screen, and filling in forms.

English Language Syntax: SIMAN modeling constructs are actual verbs, each of which describe a specific function (e.g., ASSIGN, COUNT, DELAY). SIMAN's support for user-named attributes, variables, and other language constructs allows modelers to create

highly readable, self-documented descriptions of their systems.

On-Line Help/Error Checking: On-line help is available for all modeling constructs. Also, as users enter required data into forms, error checking is performed to ensure that input is valid.

2.2.2 Built-In Flexibility

Discrete/Continuous/Combined: Users may define the model from a process interaction, event-oriented, or continuous perspective, or they may use a combination of these approaches.

Random Variables: SIMAN supports 12 popular distributions including exponential, normal, triangular, and Johnson, as well as both discrete and continuous user-defined distributions. SIMAN V provides unlimited random number streams and allows users to set or revise the seeds as required.

Exact Logic Definition: Through the use of conditional branching, looping, and if-then-else logic, the exact nature of the system being examined may be represented without writing special user routines. Parameters may be expressed in mathematical form (e.g., ProcessTime * Uniform(2.5,8.1)), conditional form (e.g., BufferCapacity < 10 .AND. MachineState == Failed), or a combination of both.

Industry-Specific Terminology: SIMAN permits modelers to name their constructs in application-specific terms. This allows a health care professional to simulate "patients," "waiting rooms," "procedures," and "nurses" instead of a manufacturing engineer's "parts," "buffers," "routings," and "machines."

FORTRAN/C Interface: SIMAN/Cinema V provides users with the ability to execute a FORTRAN or C routine from within the simulation model. Although users continue to have easy access to this capability, recent enhancements have made the need to write user-coded routines rare.

2.2.3 Special-Purpose Constructs

Conveyors: Power and free, accumulating, non-accumulating, and variable-speed conveyors, as well as a combination of the above, are all easily accessible by SIMAN/Cinema modelers. All conveyors may have variable load spacing and may experience failures.

Transporters: Free-path transporters (e.g., pushcarts, trucks) and guided transporters (e.g., AGVs, AS/RS) are supported, allowing users to model exactly the movement of objects through their systems. Acceleration/deceleration, manual or automatic velocity changes, variable-path routing, and downtime may be easily modeled.

Process Plans: SIMAN has special constructs that allow users to specify process recipes, conditional routing, and both primary and alternate process plans. Specific entity data (process times, resources required, etc.) may be varied according to the entity's current location and processing sequence.

Resources: Resources, which can be specified either by name or by mathematical or logical expression, may have both calendar- and rule-based capacity schedules. Automatic resource failures may be based on the number of parts processed, processing time, or calendar time. Priorities for obtaining resources can be dynamically declared. Users may define specific states of a resource (e.g., In Preventive Maintenance, Tool Failure, Blocked, Starved).

Blockages: SIMAN has direct support for both manual and automatic blocking based upon queue capacities or processing logic. Blockage statistics include the average time spent in a blocked state and the average number of occurrences of a particular type of blockage.

Queues: Users may define queue capacities and rankings with expressions. Queues may also be shared throughout the model.

2.3 Execution Capabilities

Execution Speed: SIMAN/Cinema is a 32-bit application, taking full advantage of 80486 and Pentiums on PCs. This advanced design allows for fast execution under the DOS, OS/2, and Unix/Ultrix operating systems without sacrificing model flexibility.

Model Size: Model size is limited only by the memory available to the operating system. SIMAN/Cinema takes advantage of both conventional and extended memory and may use disk space as virtual memory.

Interactive Run Control: The powerful Interactive Run Controller allows users to interrupt a simulation run to examine or modify system data or logic. A description of all or selected events may be printed to the screen or to a file as the simulation progresses.

Portability: SIMAN/Cinema runs under both DOS and OS/2 on PCs and under Unix/Ultrix on the SUN, DEC, HP/Apollo, and IBM workstations. Models created on any platform are source compatible on all other platforms.

2.4 Output Capabilities

Statistics Collection: Observational data, time-persistent data, and categorical frequencies may be collected for both SIMAN variables and user-defined expressions.

Independent Replications/Warm-up: Multiple replications may easily be made in a single run.

Cumulative or non cumulative statistics collected by such replications can be analyzed independently or jointly and may be cleared after a specified warm-up period.

Standard/Customized Reports: In addition to providing a standard report format for displaying collected statistics, SIMAN/Cinema supports user-customized formats.

Statistical Analysis: A complete statistical analysis module is integrated into SIMAN/Cinema and includes features such as the generation of point estimates and confidence intervals, analysis of variance, covariance estimations, data filtering, and paired- and two-sample-t tests.

Presentation Graphics: Statistics may be displayed in plot, histogram, barchart, and tabular form both during the run and post analysis.

2.5 Animation Capabilities

Integrated Model Building/Animation: Animation development can be performed concurrently with model definition. When animating a particular type of object (e.g., queue), users may select from a list of all of the objects of that type that they have currently defined (e.g., OperatorQue, MachineBuffer, InspectorWait).

Integrated Model Execution/Animation: Users may interrupt a simulation run, modify the animation, and continue the run immediately, all without exiting the program.

Object Orientation: Animation development is object oriented and features zooming, panning, scaling, rotating, and grouping of objects. High-resolution layouts may be created as detailed or as simple as desired. Although not required, pictures may be saved to libraries for later reuse.

Virtual Window Space: Cinema animations are created in a virtual drawing space, allowing users to develop large layouts that would typically require more than one screen. Users may define multiple views of a single system, any portion of which may be named and automatically displayed with a single request.

CAD Support: Cinema can import drawings from many CAD programs to display static background and to define material handling paths.

Dynamic Status Display: Overlaid plots, histograms, levels, dials, clocks, and dates allow users to watch the changing status of simulation parameters over time. "Scoreboard" summaries of relevant statistics may be created as desired.

Real Time or Post Processed: Animations may be viewed either in real time, whereby the animation is displayed while the simulation is running, or in a post-processed mode, whereby the animation is displayed after the run is complete. Advantages of real-time viewing include the ability to interrupt the model and view or modify the system status or animation characteristics. Advantages of post-processed viewing include faster, smoother graphics and the ability to skip forward quickly to a future point of interest.

3 SUMMARY

The most important criteria to consider when selecting simulation software are modeling flexibility, ease-of-use, execution speed, and animation capability. In this brief overview of the many features and benefits of using SIMAN/Cinema V, special attention has been given to the above criteria and to those features that allow for rapid modeling of manufacturing systems. A hands-on demonstration of SIMAN/Cinema will prove it to be a leader among simulation products.

4 REMARKS

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AUTHOR BIOGRAPHIES

MARK A. GLAVACH is a software engineer in Software Development with Systems Modeling Corporation and has development responsibilities for SIMAN, I/O Processors, and workstation software.

DAVID T. STURROCK is a senior systems engineer in Software Development with Systems Modeling Corporation and serves as the SIMAN Project Leader.