"A Critical Study on System Simulation and Its Applications"

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Abstract – System Simulation (SSL) is a software engineering company now specializing in text and multimedia information systems, based in Covent Garden, central London, England, and founded in 1970. Under the chairmanship of John Lansdowne, following collaborative research work at the Royal College of Art, System Simulation carried out pioneering computer animation work, applying computer graphics techniques in TV and film creating many advertising sequences, the flight deck instrumentation readouts on the Nostromo spaceship for Ridley Scott's Alien and the animation of Martin Lambie-Nairn's original Channel 4 logo.

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INTRODUCTION

More recently System Simulation has specialized in museum information systems, commercial and archival image library systems, information management and delivery for publishers, news services and professional and commercial organizations. Museum Index, the museum information management system, supports collections management, digital archives and interactive public access. Clients include the British Museum, London's Transport Museum, the Victoria and Albert Museum, Getty Images, SCRAN (Scottish Cultural Resources Access Network) and Culture. They develop content management systems, and CD-ROM/ Web products and services for the publishing sector and for information service providers. The company provides technical support for the online services of Culture, the UK's leading virtual museum resource.

Systems simulation is a set of techniques that use computers to imitate the operations of various real-world tasks or processes through simulation. Computers are used to generate numeric models for the purpose of describing or displaying complex interaction among multiple variables within a system. The complexity of the system arises from the stochastic nature of the events, rules for the interaction of the elements and the difficulty in perceiving the behavior of the systems as a whole with the passing of time.

SYSTEMS SIMULATION IN VIDEO GAMES

One of the most notable video games to incorporate systems simulation is Sim City which simulates the multiple systems of a functioning city including but not limited to: electricity, water, sewage, public transportation, population growth, social interactions including, but not limited to jobs, education and emergency response. There aren't many software engineering companies that have been developing and building innovative and effective products since 1970.
Based in Covent Garden, London, System Simulation possesses a long heritage of excellence along with a deep understanding of the potential of the web of the future. From the early days of digital galleries and the beginnings of museums on the web - to today's socially networked, interactive offerings - our projects demonstrate our unique experience.
Key products include image and digital asset management systems, collections management systems objects, archives and libraries and content management systems, with outputs to websites, kiosks, mobile devices and publications.

The term simulation is used in different ways by different people. As used here, simulation is defined as the process of creating a model i.e., an abstract representation or facsimile of an existing or proposed system e.g., a project, a business, a mine, a watershed, a forest, the organs in your body in order to identify and understand those factors which control the system and to predict the future behavior of the system. Almost any system which can be quantitatively described using equations and rules can be simulated.

The underlying purpose of simulation is to shed light on

the underlying mechanisms that control the behavior of a system. More practically, simulation can be used to predict the future behavior of a system, and determine what you can do to influence that future behavior. That is, simulation can be used to predict the way in which the system will evolve and respond to its surroundings, so that you can identify any necessary changes that will help make the system perform the way that you want it to.

For example, a fisheries biologist could dynamically simulate the salmon population in a river in order to predict changes to the population, and quantitatively understand the impacts on the salmon of possible actions e.g., fishing, loss of habitat to ensure that they do not go extinct at some point in the future.

System Simulation is the mimicking of the operation of a real system, such as the day-to-day operation of a bank, or the value of a stock portfolio over a time period, or the running of an assembly line in a factory, or the staff assignment of a hospital or a security company, in a computer. Instead of building extensive mathematical models by experts, the readily available simulation software has made it possible to model and analyze the operation of a real system by non-experts, who are managers but not programmers.

A simulation is the execution of a model, represented by a computer program that gives information about the system being investigated. The simulation approach of analyzing a model is opposed to the analytical approach, where the method of analyzing the system is purely theoretical. As this approach is more reliable, the simulation approach gives more flexibility and convenience. The activities of the model consist of events, which are activated at certain points in time and in this way affect the overall state of the system. The points in time that an event is activated are randomized, so no input from outside the system is required. Events exist autonomously and they are discrete so between the executions of two events nothing happens.

SIMSCRIPT

The SIMSCRIPT provides a process-based approach of writing a simulation program. With this approach, the components of the program consist of entities, which combine several related events into one process.In the field of simulation, the concept of "principle of computational equivalence" has beneficial implications for the decision-maker. Simulated experimentation accelerates and replaces effectively the "wait and see" anxieties in discovering new insight and explanations of future behavior of the real system.

Consider the following scenario. You are the designer of a new switch for asynchronous transfer mode (ATM) networks, a new switching technology that has appeared on the marketplace in recent years. In order to help ensure the success of your product in this is a highly competitive field, it is important that you design the switch to yield the highest possible performance while maintaining a reasonable manufacturing cost. How much memory should be built into the switch? Should the memory be associated with incoming communication links to buffer messages as they arrive, or should it be associated with outgoing links to hold messages competing to use the same link? Moreover, what is the best organization of hardware components within the switch? These are but a few of the questions that you must answer in coming up with a design.

With the integration of artificial intelligence, agents and other modeling techniques, simulation has become an effective and appropriate decision support for the managers. By combining the emerging science of complexity with newly popularized simulation technology, the PricewaterhouseCoopers, Emergent Solutions Group builds a software that allows senior management to safely play out "what if" scenarios in artificial worlds. For example, in a consumer retail environment it can be used to find out how the roles of consumers and employees can be simulated to achieve peak performance.

ANIMATION IN SYSTEMS SIMULATION

Animation in systems simulation is a useful tool. Most graphically based software packages have default animation. This is quite useful for model debugging, validation, and verification. This type of animation comes with little or no additional effort and gives the modeler additional insight into how the model. This type of animation comes with little or no additional effort and gives the modeler additional insight into how the model works. However, it augments the modeling tools available. The more realistic animation presents qualities which intend to be useful to the decision-maker in implementing the developed simulation model. There are also, good model management tools. Some tools have been developed which combined a database with simulation to store models, data, results, and animations. However, there is not one product that provides all of those capabilities.

SIMSCRIPT II.5

Without computer one cannot perform any realistic dynamic systems simulation. SIMSCRIPT II.5 is a powerful, free-format, English-like simulation language designed to greatly simplify writing programs for simulation modeling. Programs written in SIMSCRIPT II.5 are easily read and maintained. They are accurate, efficient, and

generate results which are acceptable to users. Unlike other simulation programming languages, SIMSCRIPT II.5 requires no coding in other languages. SIMSCRIPT II.5 has been fully supported for over 33 years. Contributing to the wide acceptance and success of SIMSCRIPT II.5 modeling are:

***DESIGN*:**

A powerful worldview, consisting of Entities and Processes, provides a natural conceptual framework with which to relate real objects to the model.

***PROGRAMMING*:**

SIMSCRIPT II.5 is a modern, free-form language with structured programming constructs and all the built-in facilities needed for model development. Model components can be programmed so they clearly reflect the organization and logic of the modeled system. The amount of program needed to model a system is typically 75% less than its FORTRAN or C counterpart.

***DEBUGGER*:**

A well designed package of program debug facilities is provided. The required tools are available to detect errors in a complex computer program without resorting an error. Simulation status information is provided, and control is optionally transferred to a user program for additional analysis and output.

***EVOLUTION*:**

This structure allows the model to evolve easily and naturally from simple to detailed formulation as data becomes available. Many modifications, such as the choice of set disciplines and statistics are simply specified in the Preamble.

PARALLEL AND DISTRIBUTED SIMULATION

The increasing size of the systems and designs requires more efficient simulation strategies to accelerate the simulation process. Parallel and distributed simulation approaches seem to be a promising approach in this direction. Current topics under extensive research are:

Synchronization, scheduling, memory management, randomized and reactive/adaptive algorithms, partitioning and load balancing. Synchronization in multi-user distributed simulation, virtual reality environments, HLA, and interoperability. System modeling for parallel simulation, specification, re-use of models/code, and parallelizing existing simulations.

Language and implementation issues, models of parallel simulation, execution environments, and libraries. Theoretical and empirical studies, prediction and analysis, cost models, benchmarks, and comparative studies. Computer architectures, VLSI, telecommunication networks, manufacturing, dynamic systems, and biological/social systems. Web based distributed simulation such as multimedia and real time applications, fault tolerance, implementation issues, use of Java, and CORBA.

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