Journal of Basic and Applied Engineering Research
Print ISSN: 2350-0077; Online ISSN: 2350-0255; Volume 2, Number 14; April-June, 2015 pp. 1168-1171

http://www.krishisanskriti.org/jbaer.html

Modeling, Simulation and Optimization

Preeti[1] and Manju[2]

[1]*Department of Computer Science and Application, Govt. College for women, Rohtak*
[2]*Department of Mathematics, Maharshi Dayanand University, Rohtak*
E-mail: [1]miskhokhar121@gmail.com, [2]miskhokhar131@gmail.com

Abstract—*This paper represents the overview of Modeling, Simulation and Optimization. Modeling, Simulation and Optimization form an integrated part of modern design practice in engineering and industry. Many critical questions are answered in this paper. The intended audience is those unfamiliar with area of discrete event simulation as well as beginners looking for an overview of the area.*
This includes anyone who involved in system design and modification – system analysts, management personnel, engineers, military planners, economists, banking analysts, and computer scientists. Familiarity with probability and statistics are assumed. Simulation optimization can be described as the process of finding the best input variable values from among all possibilities without explicitly evaluating each possibility.
The Objective of simulation optimization is to be minimize the resources spent while maximizing the information obtained in a simulation experiment. The purpose of this paper is to review the area of simulation optimization and How can solve real life problem using Optimization .This paper also describe the technique of Optimization, software use for Modeling and Simulation. How simulation and optimization models were combined, with the simultaneous execution, in order to achieve a feasible, Reliable and accurate solution for problem. The main concern when building a simulation model is to be assure that the model will correctly represent the real system.

1. INTRODUCTION

Modeling is the process of producing a model and a model is a representation of the construction and working of some system of interest. A model should be a close approximation to the real system and incorporate most of its salient features. On the other hand, it should not be too complex that it is impossible to understand and experiment with it. A good model is the judicious tradeoff between realism and simplicity. Mathematical model classifications include deterministic (input and output variables are fixed values) or stochastic (at least one input or output variables is probabilistic) static (time is not taken into account) or dynamic (time-varying interactions among variables are taken into account). Simulation models are typically stochastic and dynamic.

2. WHAT IS MODELING ?

A model intended for a simulation study is a mathematical model developed with the help of simulation software. Where Modeling implements in Animation which is the process of displaying still image in a rapid sequence to create the illusion of movement and modeling is an important key of the animation. Modeling use for design the model. Different kind of model has been design using Max and Maya software. Generally, Maya is the 3-D animation software that provides a number of tools for creating complex characters and animations. However, Maya's powerful feature set gives us the flexibility to create any kind of animation. The functionality of the Maya software is to be extended with the use of MEL (Maya embedded language). MEL can be used to customize the user to interface and write scripts and macros. Maya can create the objects, lights, cameras and textures. Any kind of object, light, camera, or just any entity can be animated by changing the value of its parameters in time. We can use Maya to create effects or animations or movies commercials, architectural animation and forensic animation.

3. WHAT IS SIMULATION?

A simulation of a system is described as the operation of a model of the system. The model can be reconfigured and experimented with usually, this is impossible and too expensive or impractical to do in the system it represents.

The operation of the model can be studied and hence the properties concerning the behavior of the actual system or its subsystem can be inferred. Generally, In its broadest sense, simulation is a tool to evaluate the existing or proposed, performance of a system, under different configurations of interest and over long periods of real time.

Simulation is used before an existing system is altered or a new system built, to eliminate unforeseen bottlenecks, to reduce the chances of failure to meet specifications, to prevent under or over-utilization of Resources, and to optimize system performance. Where Fig. 1 is a schematic of a simulation study.

The iterative nature of the process is indicated by the system under the study of becoming the altered system which then becomes the system under study and the cycle repeats. In a simulation study, human decision making is required at all stages, namely, model development, experimental design, output analysis, conclusion formulation, and making decisions to alter the system under study.

The only stage where human intervention is not to be required is the running of the simulations, which most simulation Software packages perform efficiently. The important point is that powerful simulation software is barely a hygiene factor - its absence can hurt a simulation study, But its presence will not ensure success. Experienced problems formulators and simulation modelers and analysts are indispensable for a successful simulation study.

The steps are involving in developing a simulation model, designing a simulation experiment, and performing simulation analysis are:

Step 1. Identify the problem.
Step 2. Formulate the problem.
Step 3. Collect and process real system data.
Step 4. Formulate and develop a model.
Step 5. Validate the model.
Step 6. Document model for future use.
Step 7. Select appropriate experimental design.
Step 8. Establish experimental conditions for runs.
Step 9. Perform simulation runs.
Step 10. Interpret and present results.

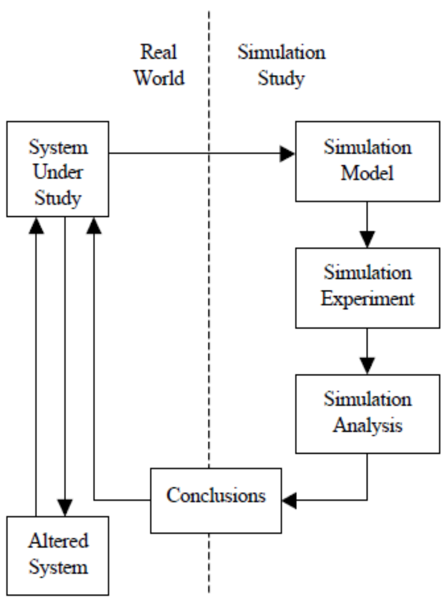

Figure 1: Simulation Study Schematic

4. WHAT IS OPTIMIZATION?

Actually, An optimization tool is traditionally used to find the best way to execute some task. The objective of the optimization model is to run each time that the simulator program begin, to produce initial allocation of the loader and transportation equipment.

This model will also run during the simulation, when equipment and a truck failure may happen, seeking a new optimal allocation for shovel and remaining trucks. It will also generate shovels allocation to the different mining areas and will calculate amount of trips that each truck should take to each area, to reach production goal.

5. HOW TO SELECT SIMULATION SOFTWARE?

Although a simulation model can be built using general purpose programming languages which are familiar to the analyst, available over a wide variety of platforms, and less expensive, most simulation studies today are implemented using a simulation package. The advantages are reduced programming requirements, natural framework for simulation modeling, conceptual guidance, automated gathering of statistics graphic symbolism for communication; animation and increasingly, flexibility to change the model. There are hundreds of simulation products on the market in many with price tags of $15,000 or more. Naturally, the question of how to select the best simulation software for an application arises. Metrics for evaluation include modeling flexibility, ease of use, modeling structure code reusability, graphic user interface, animation, dynamic business graphics, hardware and software requirements, statistical capabilities, output reports and graphical plots, customer support, and documentation. The two types of simulation packages are simulation languages and application-oriented simulators (Table 2).

However, Simulation languages offer more flexibility than the application-oriented simulators. Languages require varying amounts of programming expertise. Weather Application-oriented simulators are easier to learn and have modeling constructs closely related to the application. Most simulation packages incorporate animation which is excellent for communication and can be used to debug the simulation program a "correct looking" animation and it is not a guarantee of a valid model. More importantly, animation is not a substitute for output analysis.

Table 2: Simulation Packages

Type Of Simulation Package	Examples
Simulation languages	Arena (previously SIMAN), AweSim! (previously SLAM II), Extend, GPSS, Micro Saint, SIMSCRIPT, SLX Object-oriented software: MODSIM III, SIMPLE++ Animation software: Proof Animation
Application -Oriented Simulators	Manufacturing: Auto Mod, Extend+MFG, FACTOR/AIM, ManSim/X, MP$IM, Pro Model, QUEST, Taylor II, WITNESS Communications/computer: COMNET III, NETWORK II.5, OPNET Modeler, OPNET Planner, SES/Strategizer, SES/workbench Business: BP$IM, Extend+BPR, Process Model, Service Model, SIMPROCESS, Time machine Health Care:

6. BENEFITS OF SIMULATION MODELING AND ANALYSIS

According to practitioners, simulation modeling and analysis is one of the most frequently used operations research techniques. Simulation modeling and analysis makes it possible to Obtain a better understanding of the system by developing a mathematical model of a system of interest and observing the system's operation in detail over long periods of time. Whether, Test hypotheses about the system for feasibility. Actually, Compress time to observe certain phenomena over long periods or expand time to observe a complex phenomenon in detail. Study the effects of certain informational, organizational, environmental and policy changes on the operation of a system by altering the system's model, this can be done without disrupting the real system and significantly reduces the risk of experimenting with the real system. However, Experiment with new or unknown situations about which only weak information is available. Identify the "driving" variables - ones that performances measure is the most sensitive to - and the inter-relationships among them. Identify bottlenecks in the flow of entities (material and people etc.) or information. Use multiple performances metrics for analyzing system configurations. Employ a system approaches to problem solving. Develop well designed, robust systems and reduce system development time.

7. OPTIMIZATION MODEL PARAMETERS

Optimization model main data include:

- Minimum and maximum capacity of each load equipment
- Trucks capacity
- Total production to be reached
- Range of desired grades for each control variable (minimum and maximum grade of Run of Mine)
- Grades for each control variables to each mining area
- Weight of each control variables

There is an open pit mine working with system shovels and trucks, where there was a grade control of several involved variables. This job is consider the grade control of chemical variables in each grand-size partition of the areas (pellet feed, sinter feed and lump ore).

For each short-term mining plan elaborated, there are n available areas, where the mine can be operated simultaneously in m ($m \leq n$) of those areas, depending of the shovels available. If these equipment start to operate, due to technical and economical reasons, each loader equipment shall work between production limits previously defined.

Each truck should assist only mining area and, an area can have more than one truck allocated.

8. FEATURE AND LIMITATION OF THE OPTIMIZER

The optimizer can be used to do all system planning, indicating the trucks/shovels allocation, with the respective trucks trips plan calculation or simply to do trucks allocation and its trips planning.

The optimizer will have the following constraints:

30 mining areas, 80 transport equipments (trucks)

- 15 shovels.
- 2 unload point (1 for ore and 1 for waste).
- 6 control variables in 3 size fractions.

9. OPTIMIZATION PROBLEMS

Most real-world problems are concerned with maximizing or minimizing some quantity so as to optimize some outcome. Whether, Calculus is the principal "tool" in finding the Best Solutions to these practical problems. These are the steps in the Optimization Problem-Solving Process:

(1) Draw a diagram depicting the problem scenarios, but show only the essentials.

(2) Give the diagram symbols.

(3) Analyze the diagram, relating the "known" tends to the "unknowns".

(4) Find the extreme values using the Calculus.

We will illustrate application of this process by solving several "Optimization Problems".

An optimization problem can be represented in this following way:

Given: a function $f : A \rightarrow R$ from some set A to the real numbers

Sought: an element x_0 in A such that $f(x_0) \leq f(x)$ for all x in A ("minimization") or such that $f(x_0) \geq f(x)$ for all x in A("maximization").

Such a formulation is called an optimization problem or a mathematical programming problem (a term not directly related to computer programming, but still it is in use for example in linear programming –Many real-world and theoretical problems may be modeled in this general framework. Problems formulated using this technique in the fields of physics and computer vision may refer to the technique as energy minimization and speaking of the value of the function f as representing the energy of the system being modeled.

Typically, A is the some subset of the Euclidean space R^n, often specified by a set of constraints, equalities or inequalities that the members of A have to satisfy. The domain A of f is called the search space or the choice set, while the elements of A are called feasible solutions.

The function f is called variously, an objective function, a loss function or cost function (minimization), a utility function or fitness function (maximization), or in certain fields, an energy function or energy functional. A feasible solution that minimizes or maximizes (if that is the goal) the objective function is called an optimal solution. In Mathematics, by convention optimization problems are stated in terms of minimization. Generally, unless both the objective function and the feasible region are convex in a minimization problem, there may be several local minima, where a local minimum x^* is defined as a point for which there exists some $\delta > 0$ so that for all x such that

$$||x-x^*||<= \delta;$$

The expression

$$f(x^*)<=f(x)$$

holds that is to say, on some region around x^* all of the function values are greater than or equal to the value at that point. Whether, Local maxima are defined similarly. A large number of algorithms proposed for solving non-convex problems – including the majority of commercially available solvers – are not capable of making a distinction between local optimal solutions and rigorous optimal solutions and will treat the former as actual solutions to the original problem. The branch of applied mathematics and numerical analysis that is concerned with the development of deterministic algorithms that are capable of guaranteeing convergence in finite time to actual optimal solution of a non-convex problem is called global optimization.

10. CONCLUSION

This paper explain Modeling, Simulation and Optimization and use of modeling in animation, and how select simulation software, review the area of simulation optimization and How can solve real life problem using Optimization.

11. ACKNOWLEDGMENT

The research paper was finished under the instruction of Organization "Krishi Sanskriti" .This work was supported in part by a grant from the National Science Foundation.

REFERENCES

[1] Banks, J., J. S. Carson, II, and B. L. Nelson. 1996.Discrete-Event System Simulation, Second Edition,Prentice Hall.

[2] Bratley, P., B. L. Fox, and L. E. Schrage. 1987. A Guide to Simulation, Second Edition, Springer-Verlag.

[3] Nelson, B. L. 1995. Stochastic Modeling: Analysis and Simulation, McGraw-Hill.

[4] Kleijnen, J. P. C. 1987. Statistical Tools for Simulation Practitioners, Marcel Dekker, New York.

[5] Costa, F. P., M. J. F.Souza, L. R. Pinto. 2004. Um modelo de programação dinâmica de caminhões. Revista Brasil Mineral,231:26-31. (in portuguese)