Simulation Modeling and Optimizatiom

Students Name

Institutional Affiliation

Simulation Modeling and Optimization

The term modeling refers to the process of developing models. In this case, a model refers to digital representations of the dynamics of a particular system of interest. Typically a model is designed in such a way that it is similar but simpler than the system it represents. Models assist analysts in predicting the performance or analyzing how a certain change would impact the physical system. In modeling, one of the essential aspects of a model is its validity. Validity refers to how accurately the model predicts the actual system (Birta & Arbez,2007). Validating a model entails running it under known inputs and comparing the output of the model to that of the actual system. After models have been developed, companies need to select the best alternative through model optimization. This paper expounds on the process of simulation modeling and optimization.

The process of simulation modeling involves the development of digital models of real physical systems to enable designers to predict their performance or the impact of changes on their performance (Birta & Arbez, 2007). Simulation modeling is applied during the development of new systems or making alterations to already existing systems. Through simulation modeling, designers can minimize the risk of failing to meet expectations, avoid unforeseen challenges, ensure optimum utilization of resources and save cost by reducing the number of physical prototypes developed before coming up with the final system. For example, if a company decides to develop a new communication network to link up the various departments, the company can use simulation modeling to determine on the best design and to figure out how specific variations may affect the network. Through such a simulation, the company will be able to save the amount of time and cash spent in developing a system and later making modifications after the network has already been set up.

 There are several steps that companies should follow in the development of a simulation model. The first step involves identifying the problem. Problem identification entails identifying the required amendments in an existing system or coming up with the requirements for a proposed system. The next step involves formulating the problem. Problem formulation entails developing objectives and coming up with a list of specific issues that need to be addressed by the model to be developed. The third step requires the collection of necessary data that will assist in the development and validation of the model. After data collection, the required model should be formulated and developed (Birta & Arbez, 2007). The formulation and development of a simulation model require the use of an appropriate simulation modeling computer software. Some of the available simulation software include COMSOL, Autodesk, and Matlab among others.

 After the model has been developed, the next step is to validate it. Model validation requires the developed model to be tested by running it under known conditions from the actual system. If the model produces the same output as the real system using the same input, then it is a valid model. After testing the validity, the steps that follow are documenting the developed model, selecting an appropriate experimental design to test the model, establish the different condition to conduct the various experimental run and finally, perform the runs, interpret the results and make the appropriate recommendations (Birta & Arbez, 2007).

According to analysts, simulation modeling is currently one of the most applied techniques for operations research by companies (Panneerselvam, 2013). Some of the known benefits of simulation modeling include the provision of an improved understanding of systems through developing their simplified models; simulation modeling also enables companies to build and test a performance-based hypothesis about their methods and test the feasibility of changes in operations or systems (Panneerselvam, 2013).

Moreover, simulation modeling also enables companies to explore various unknown conditions or situations with only a little information and identify possible challenges and solutions before undertaking a particular intervention. Through simulation, modeling companies are also able to save the time and costs associated with the development or improvement of a system. Despite the numerous advantages, simulation modeling can be a complicated and time-consuming exercise.

Sometimes, companies are faced with situations where they have to choose between different models or where they need to reduce the amount of resources spent while at the same time maximizing the information acquired. In such situations, companies need to choose a model that maximizes the benefits and minimizes the losses. The process through which companies select the best alternative to optimize performance under a given set of constraints is referred to as optimization. In simulation modeling, optimization is aided by linear programming techniques. Other simulation-optimization techniques include the use of likelihood ratios, computer software, and the frequency domain method and the response surface methodology. To be able to conduct model optimization it is essential for companies to begin by identifying their desired outcome from a model (Nicholson, 2017).

To enjoy the benefits of simulation modeling, companies should ensure that they avoid developing unclear or unrealistic objectives, developing too simple or too complex simulation models, erroneous assumptions in developing the model, utilizing the wrong performance measures and using the wrong computer software for simulation (Singh, 1996). Evidently, simulation modeling and optimization is crucial for companies. However, to enjoy the benefits companies should ensure that they follow all the steps and guidelines involved in simulation modeling as well as optimization.

References

Birta, L. G., & Arbez, G. (2007). *Modeling and Simulation: Exploring Dynamic System Behaviour*

Nicholson, T. A. (2017). *Optimization in Industry: Volume 2, Industrial Applications*. Transaction Publishers.

Panneerselvam, R. (2013). System simulation, modeling and languages. Place of publication not identified: Prentice-Hall of India PV.

Singh, N. (1996). *Systems approach to computer-integrated design and manufacturing*. New York: Wiley.