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DYNAMIC SIMULATION AND MODELING OF PHYSICAL BEHAVIOR

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I. INTRODUCTION

Simulations are abstractions of reality. It is defined as the mechanism of creating a model 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 clarify and understand those factors which control the system to predict the futuristic behavior of the system. Modeling is the representation of an object or phenomena, which is used by simulation. Modeling and simulation is a leading way that companies are reducing their development time while maintaining or increasing the quality of their products.

Some well-known simulation and modeling:

- Continuous simulation
 - Discrete and combined simulation
 - Differential inclusions in Modeling and Simulation.
 - Computational fluid dynamics.
 - Artificial Intelligence Techniques
 - Multi-resolution and heterogeneous modeling
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- Graphical Modelling
 - Curve, surface, and manifold modeling
 - Feature modeling, recognition, understanding
 - Geometric Modelling
 - Solid Modelling
 - Hair Modelling
 - Modelling of Natural Phenomena
 - Sound simulation
 - Simulation of natural phenomena
 - Texture Models
 - Physically-based modeling and simulation
 - Human simulation
 - Clothing simulation
 - Shape modeling, synthesis, and analysis
-

II. WORKING

In many applications (prototyping and simulation, movies, games ...) the physically correct behavior of 3D objects is an important issue. This behavior should for example consider the dynamics of rigid bodies. Here objects can move through space, collide with each other and are liable to the laws of friction. Once one can simulate that, there is the possibility to add more degrees of freedom, e.g. object deformation by external and internal forces. With finite element methods these deformations can be handled in an efficient way. If we further increase the deformable character of the objects we may get materials like fluids or gases. Once all these phenomena can be handled, a next step would be to simulate the interaction between all these different matters. Our goal in this context one the one hand is to integrate as many of these physical effects as possible to gain maximum physical correctness and on the other hand we want do to this as fast as possible, i.e. in real time. Clearly there is a tradeoff between these goals. Desirable are algorithms which cover the whole range of application whereas the tradeoff between efficiency and precision can be controlled by a simple parameter.

III. CONCLUSION

Computer-simulation is the use of a computer to model the dynamic responses of one system by the behavior of another system modeled after it. A simulation uses a mathematical description mechanism, or model, of a real system in the form of a computer program. This model is composed of equations that duplicate the functional relationships within the real and feasible system. When the program is on run, the resulting mathematical dynamics form an analog of the behavior of the real system, with the results represented in the form of data. A simulation can also take the form of a computer-graphics image that represents dynamic processes in an animated sequence consequently.

Computer simulations are used to study the dynamic nature of objects or systems in response to conditions that cannot be easily or safely or truly applied in real life. For example, a nuclear blast can be explored by a **mathematical model** that incorporates such variables as heat, velocity, and radioactive emissions. Additional mathematical equations can then be



used to feasible the model to adjust in certain variables, such as the amount of fissionable material that produced the blast. Simulations are especially useful in enabling observers to analyze and predict how the operation of an entire system may be affected by altering or modifying individual components within that system.

The simpler simulations performed by personal computers consist mainly of business models and geometric models. The former includes spreadsheet, financial and statistical software programs that are used in business analysis and planning. Geometric models are used for numerous applications that require simple mathematical modeling of objects, such as buildings, industrial parts, and the molecular structures of chemicals. More advanced simulations, such as those that emulate weather patterns or the behavior of macroeconomic systems, are usually performed on powerful workstations or on mainframe computers. In engineering, computer models of newly designed structures undergo simulated tests to determine their responses to stress and other physical variables. Simulations of river systems can be manipulated to determine the potential effects of dams and irrigation networks before any actual construction has taken place. Other examples of computer simulations include estimating the competitive responses of companies in a particular market and reproducing the movement and flight of space vehicles.

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