# SIMULATION MODEL BUILDING pdf

## 1: Best Simulation Software | Reviews of the Most Popular Systems

*Simulation modeling is the process of creating and analyzing a digital prototype of a physical model to predict its performance in the real world. Simulation modeling is used to help designers and engineers understand whether, under what conditions, and in which ways a part could fail and what loads it can withstand.*

It is also used to evaluate the payback of green energy solutions like solar panels and photovoltaics, wind turbines and high efficiency appliances. Building simulation is the process of using a computer to build a virtual replica of a building. In a way, building simulation is a way to quantitatively predict the future and thus has considerable value. Building simulation is commonly divided into two categories: Load Design, and Energy-Analysis. The common phrase for building simulation when energy is involved is Energy-modeling. Load Design is used to determine: Predict the monthly energy consumption and bills Predict the annual energy cost Annual CO2 emmissions Compare and contrast different efficiency options Determine life cycle payback on various options Who benefits from Energy-modeling? Engineers No more giant spreadsheets! Manufacturers Quantitatively prove that your product saves money in X amount of time. Building Owners Get the most bang for your buck up fron! How do I make a building simulation or energy-model? In order to simulate a building on a computer, the appropriate software is needed. There are literally hundreds of options. We here at energy-models. Either software package can be learned in a short period of time, but it takes years to become a master just like anything else worthwhile. What do I need before I get started with Energy Modeling? Building location and geometry Building materials walls, windows, u-values, shading coefficients General operation of the building All interior load values Lighting, plug loads, occupant numbers and activity level. Zoning requirements System types is it constant volume or VAV? DX coils or chilled water? You need to be smart Which software is best? This is not for us to say! Each package has its pros and cons. Some packages have very good functionality but poor interface, while others have brilliant interfaces and limited functionality. It really depends on what you are doing. Keep in mind that it focuses almost solely on energy and that load design in eQUEST should be limited to the experts. Tell your boss to suck it up and buy it for you. It comes with free support.

## 2: Simulation modeling - Wikipedia

*Simulation Models. A simulation model is a mathematical model that calculates the impact of uncertain inputs and decisions we make on outcomes that we care about, such as profit and loss, investment returns, environmental consequences, and the like.*

The application of compositional models is discussed briefly in reservoir rock and fluid properties. The most important geological features are faults, variation in reservoir parameters, and the layering style, or stratigraphy. Well completions must also be resolved in the reservoir simulation grid. These features are preserved by carefully defining the areal grid and the layering by use of processes described below. Input data from geological modelling. Input data from geological modelling includes: Structural modelling geological grid, faults and fault properties, reservoir zonation, vertical communication, fluid contacts Property modelling porosity, permeability, net-to-gross ratio, initial water saturation, end-point fluid saturations. Areal grid and layering To represent spatial variation in the reservoir properties, gridblocks must be smaller than the features being represented. For example, representing sinuous channels requires that the gridblock dimensions be at most one-third of channel width. In the absence of specific geologic objects, a rule of thumb is that the reservoir simulation cell dimension should be approximately twice that of the geological model cell in X- and Y-directions in areas where hydrocarbons and wells are presented. Variation of saturation and pressure around the wells depend strongly on reservoir description, fluid properties and flow rates. Therefore, the best way to decide on grid resolution near the wells is to conduct a gridding study in a finer scale element model representing the area around a well. Another issue is the proper representation of fluid contacts. A thin oil rim cannot be resolved in the layer thickness or areal grid-block size if it is larger than the dimensions of the oil rim. Layering style in the reservoir simulation model usually is set to be the same as that in the geological model. The objective in layer selection is to determine the number of layers to preserve the heterogeneity seen in the geological model. Choice of layering is also affected by the displacement processes. It is important that the layers in the model be thin enough to resolve the location of well completions and vertical movement of fluid to those completions. Vertical communication Vertical communication between reservoir simulation grid layers is important for describing correct flow displacement in reservoirs, both vertically and areally. This input should be based on the structural and petrophysical analysis and should provide vertical transmissibility multipliers to be used in the reservoir simulation model. Faults and fault properties Most reservoirs are faulted and faults often must be represented in reservoir simulation models. Sometimes the model can be simplified by treating faults as vertical. This decision depends on the detailed fault geometry, and how it intersects with the fluid contacts, the wells, and the property variation on either side of each fault. If the sand or shale thicknesses are the same as the fault throw, it will be important to represent the juxtaposition of reservoir properties across the faults, and slant faults may be necessary. Similarly, if the fluid contacts impinge on the faults or if wells are near faults, it will be important to represent fault geometry more accurately. Aquifer properties As much of the rock containing the aquifer as practical should be included in the reservoir simulation grid with the corresponding aquifer properties assigned: This is needed to establish an appropriate dynamic picture in the reservoirs. Upscaling static properties Reservoir properties often need to be up-scaled if the geological static model is built on a finer scale in terms of cell size than is intended for the simulation model. This property upscaling should be done after the 3D-reservoir simulation grid has been constructed. Porosity and Net-to-Gross The up-scaled porosity and NTG should preserve the pore volume of the underlying geological model. In this case the bulk-volume weighted averages give the correct porosity. Saturations The up-scaled saturations should preserve the volume of each phase in the volume associated with each grid-block. In this case pore-volume-weighted averaging will give the correct result. Permeability As a flow property, permeability should be defined as a diagonal tensor and up-scaled by using flow based up-scaling techniques. It can be verified if arithmetic-harmonic horizontal and vertical permeability upscaling yields a reservoir simulation model with reasonable behavior and similar to that with tensor upscaling, which in some cases tends to underestimate vertical communication and is therefore trickier to use. Reservoir rock and fluid properties Rock compressibility Rock compressibility is one of the most important input parameters for initialization of any reservoir simulation study. This parameter should be based on core analysis and rock mechanics studies. It is recommended not to change this parameter during the history matching process, if possible. If modified, it should be checked with the team members representing the rock mechanics discipline. This needs to be done to ensure that final rock compressibility applied in the model has a physical meaning. Fluid PVT data The two most common types of reservoir fluid models are black-oil models and compositional models. The black-oil models are based on the assumptions that the saturated phase properties of two hydrocarbon phases oil and gas depend on pressure only. Compositional models also assume two hydrocarbon phases, but they allow the definition of many hydrocarbon components. The time cost of running a compositional simulator increases dramatically with an increase in the number of components modeled, but the additional components make it possible to more accurately model complex fluid phase behavior. If compositional model results are to be used in a process engineering model, it is often necessary to compromise on the number of components to be used for each application. The typical fluid PVT properties used in reservoir simulation study, are: Relative permeability and capillary pressure Relative permeability curves represent flow mechanisms, such as drainage or imbibition processes, or fluid wettability. Relative permeability data should be obtained by experiments that best model the type of displacement processes in the reservoirs. The modelling team should recognize that the relative permeability curves used in a flow model may be very dependent on the experiment that was used to measure the curves. Applying these curves to another type of displacement mechanism can introduce significant error. Capillary pressure Capillary pressure is usually included in reservoir simulation studies. The relationship between capillary pressure and elevation is used to establish the initial transition zone in the reservoir. Similar zones may exist at the interface between other pairs of immiscible phases. Capillary pressure data is primarily used for determining initial fluid contacts and transition zones. If petrophysical evaluation and property modelling concludes that there is a relative thick transition zone, then capillary pressure should be used; however, if the transition zone is considered to be negligible, then no major benefit can be expected from the use of capillary pressure data. Dynamic properties and well data Dynamic properties and well data are primarily required for the following: The historical well tubing head pressure, well bottomhole pressure, well productivity index PI , and well flow performance tables are required to calibrate reservoir simulation models when reservoir simulation models are used for predictions in other words, when the wells are changed from volume control to pressure control. Well data The well data trajectory and perforation intervals are required to assign well perforation intervals to the reservoir simulation grid and simulate well performance. Production, injection and pressure constraints for facilities and wells These data are required, particularly when reservoir simulation models are used for predictions. Reservoir simulation model initialization and validation Reservoir simulation model initialization To initialize a reservoir simulation model, the initial oil, gas and water pressure distribution and initial saturations must be defined in the reservoir model. Pressure data are usually referenced to some datum depth. It is convenient to specify a pressure and saturation at the datum depth and then to calculate phase pressures based on fluid densities and depths. The initialization of the reservoir simulation models is the process where the reservoir simulation model is reviewed to make sure that all input data and volumetrics are internally consistent with those in the geomodel. The reservoir simulation model should normally be in dynamic equilibrium at the start of production, but there might be some exceptions to that rule. Non-equilibrium at initial conditions may imply some data error or the need to introduce pressure barriers thresholds between equilibrium regions. Reservoir simulation model validation At this step, the main objective is to verify that the reservoir simulation model accurately represents the structure and properties in the geologic model. The following validation steps are recommended: Visualize reservoir simulation grid, each grid layer and each cross-section, to ensure that simulation grid is constructed correctly and all gridblocks are suitable for reservoir simulations. Compare reservoir simulation grid with the geological grid and make sure that reservoir simulation grid layers and fault geometries are consistent with the structural depth maps used. Visualize and compare reservoir simulation model properties porosity, permeability, net-to-gross ration and fluid saturation with those in the geological model. Compare reservoir simulation model gross-rock-volume, pore volume, and hydrocarbon in-place volumes with the geological model volumes Verify that the wells are consistently represented in the reservoir simulation grid. Traditionally, history matching is performed by a trial-and-error approach. In this case, a lot of manual tasks are involved, such as changing the reservoir simulation model, running reservoir simulations, plotting curves and comparing to observed data. The main advantage of assisted history matching is to automate those manual tasks, such as reservoir simulation model modifications, running reservoir simulations, comparison of observed and reservoir simulation data, etc. History matching input data The following historical measured input data for individual wells or reservoirs are typically used in history matching process: RFT pressures measured pressure points vs. Match average reservoir pressure and field rates to have a good understanding about material balance in the reservoir. Match individual well RFT pressure to have control on compartmentalization and flow barriers. History match quality There are several ways to decide if a match is satisfactory. In all cases, a clear understanding of the study objectives should be the reference for making the decisions. For example, if a coarse study is being performed, the quality of the match between observed and simulated parameters does not need to be as accurate as it would be for a more detailed study. Quality of Modifications Made. If the model has a good match but the changes made were not realistic, then the model results should be viewed with skepticism. Remember that the ultimate objective of reservoir simulation is not achieving a history match; it is being able to reasonably predict the future performance of the reservoir. The history match is only an intermediate step in the modelling process. Reservoir simulation model prediction capability The reservoir simulation model-building process and history matching are intended to provide a working model of the reservoir and establish a level of confidence in the validity of a flow model. Therefore, the final history matched model is usually re-configured to predict the behavior of the reservoir into the future. When a reservoir simulation model is changed from history matching to prediction mode, the phase rate profiles should be smooth, provided new wells are not added or existing wells shut-in, and the fundamental constraints on the wells are not changed. There should not be a shift up or down in rates at this point. Such a shift is usually indicative of non-calibrated wells. It is recommended that the last year of history is run in prediction mode and the actual production compared with the simulated prediction. While this should not be expected to give a perfect match, it will help to highlight major discrepancies in the model. When a reservoir simulation model is used for predictions, the limitations and uncertainties involved in the reservoir simulation models should be recognized. If the geological model, for example, is not reasonable and observed data quality is poor, not much quality can be expected from reservoir simulation model, no matter the quality of the history match. Reservoir Simulation includes associated papers and Society of Petroleum Engineers. Englewood Cliffs - N. Principles of applied reservoir simulation.

## 3: Energy Modeling | www.enganchecubano.com

*EnergyPlus is a whole-building energy simulation program that engineers, architects and researchers use to model both energy consumptionâ€”for heating, cooling, ventilation, lighting and plug and process loadsâ€”and water use in buildings.*

Your model now has the blocks you need. Arrange the blocks as follows by clicking and dragging each block. To resize a block, click and drag a corner. Connect Blocks Connect the blocks by creating lines between output ports and input ports. Click the output port on the right side of the Pulse Generator block. The output port and all input ports suitable for a connection get highlighted. Click the input port of the Gain block. Simulink connects the blocks with a line and an arrow indicating the direction of signal flow. Connect the output port of the Gain block to the input port on the Integrator, Second Order block. Connect the two outputs of the Integrator, Second Order block to the two Outport blocks. Access the context menu by right-clicking the signal. A viewer icon appears on the signal and a scope window opens. You can open the scope at any time by double-clicking the icon. Run Simulation After you define the configuration parameters, you are ready to simulate your model. On the model window, set the simulation stop time by changing the value at the toolbar. The default stop time of  This time value has no unit. Time unit in Simulink depends on how the equations are constructed. This example simulates the simplified motion of a car for 10 seconds â€" other models could have time units in milliseconds or years. To run the simulation, click the Run button. The simulation runs and produces the output in the viewer. In this scenario, a digital sensor measures the distance between the car an obstacle 10 m 30 ft away. The model outputs the sensor measurement, and the position of the car, taking these conditions into consideration: The car comes to a hard stop when it reaches the obstacle. In the physical world, a sensor measures the distance imprecisely, causing random numerical errors. A digital sensor operates at fixed time intervals. The Integrator, Second Order block has a parameter for that purpose. Double-click the Integrator, Second Order block. The Block Parameters dialog box appears. Select Limit x and enter 10 for Upper limit x. The background color for the parameter changes to indicate a modification that is not applied to the model. Click OK to apply the changes and close the dialog box. Add New Blocks and Connections Add a sensor that measures the distance from the obstacle. Extend the model window to accommodate the new blocks as necessary. Find the actual distance. To find the distance between the obstacle position and the vehicle position, add the Subtract block. Also add the Constant block to set the constant value of 10 for the position of the obstacle. Model the imperfect measurement that would be typical to a real sensor. Set the Noise power parameter to 0. Add the noise to the measurement by using an Add block from the Math Operations library. Model the digital sensor that fires every 0. In Simulink, sampling of a signal at a given interval requires a sample and hold, implemented by a zero-order hold. Add the Zero-Order Hold block from the Discrete library. After you add the block to the model, change the Sample Time parameter to 0. Add another Outport to connect to the sensor output. Leave the Port number parameter as default. Connect the new blocks. Note that the output of the Integrator, Second-Order block is already connected to another port. To create a branch in that signal, left-click the signal to highlight potential ports for connection, and click the appropriate port. Annotate signals Add signal names to the model to make it easier to understand. An editable textbox appears. Type the signal name. To finish, click away from the textbox. Repeat these steps to add the names as shown. Compare Multiple Signals Compare the actual distance signal with the measured distance signal. Create and connect a Scope to the actual distance. Note that the name of the signal appears in the viewer title. Add the measured distance signal to the same viewer. Make sure you are connecting to the viewer you created in the previous step. The Viewer shows the two signals, actual distance in yellow and measured distance in blue. Zoom into the graph to observe the effect of noise and sampling. Click the Zoom button. Left-click and drag a window around the region you want to see. You can repeatedly zoom in to observe the details. From the plot, you can see that the measurement can deviate from the actual value by as much as 0. This information becomes useful when designing a safety feature, for example, a collision warning.

## 4: Best Directory | Building Energy Software Tools

*â€¢ A simulation model of a complex system can only be an approximationto the actual system, no matter how much time and money is spent on model building. There is no such thing as absolute model validity, nor is it even desired.*

By contrast, computer simulation is the actual running of the program that contains these equations or algorithms. Simulation, therefore, is the process of running a model. Thus one would not "build a simulation"; instead, one would "build a model", and then either "run the model" or equivalently "run a simulation". History[ edit ] Computer simulation developed hand-in-hand with the rapid growth of the computer, following its first large-scale deployment during the Manhattan Project in World War II to model the process of nuclear detonation. It was a simulation of 12 hard spheres using a Monte Carlo algorithm. Computer simulation is often used as an adjunct to, or substitute for, modeling systems for which simple closed form analytic solutions are not possible. There are many types of computer simulations; their common feature is the attempt to generate a sample of representative scenarios for a model in which a complete enumeration of all possible states of the model would be prohibitive or impossible. Data preparation[ edit ] The external data requirements of simulations and models vary widely. For some, the input might be just a few numbers for example, simulation of a waveform of AC electricity on a wire , while others might require terabytes of information such as weather and climate models. Input sources also vary widely: Sensors and other physical devices connected to the model; Control surfaces used to direct the progress of the simulation in some way; Current or historical data entered by hand; Values extracted as a by-product from other processes; Values output for the purpose by other simulations, models, or processes. Lastly, the time at which data is available varies: Because of this variety, and because diverse simulation systems have many common elements, there are a large number of specialized simulation languages. The best-known may be Simula sometimes called Simula, after the year when it was proposed. There are now many others. Systems that accept data from external sources must be very careful in knowing what they are receiving. While it is easy for computers to read in values from text or binary files, what is much harder is knowing what the accuracy compared to measurement resolution and precision of the values are. Often they are expressed as "error bars", a minimum and maximum deviation from the value range within which the true value is expected to lie. Because digital computer mathematics is not perfect, rounding and truncation errors multiply this error, so it is useful to perform an "error analysis" [11] to confirm that values output by the simulation will still be usefully accurate. Even small errors in the original data can accumulate into substantial error later in the simulation. While all computer analysis is subject to the "GIGO" garbage in, garbage out restriction, this is especially true of digital simulation. Indeed, observation of this inherent, cumulative error in digital systems was the main catalyst for the development of chaos theory. Types[ edit ] Computer models can be classified according to several independent pairs of attributes, including: Stochastic or deterministic and as a special case of deterministic, chaotic â€" see external links below for examples of stochastic vs. Another way of categorizing models is to look at the underlying data structures. For time-stepped simulations, there are two main classes: Simulations which store their data in regular grids and require only next-neighbor access are called stencil codes. Many CFD applications belong to this category. If the underlying graph is not a regular grid, the model may belong to the meshfree method class. Equations define the relationships between elements of the modeled system and attempt to find a state in which the system is in equilibrium. Such models are often used in simulating physical systems, as a simpler modeling case before dynamic simulation is attempted. Dynamic simulations model changes in a system in response to usually changing input signals. Stochastic models use random number generators to model chance or random events; A discrete event simulation DES manages events in time. Most computer, logic-test and fault-tree simulations are of this type. In this type of simulation, the simulator maintains a queue of events sorted by the simulated time they should occur. The simulator reads the queue and triggers new events as each event is processed. It is not important to execute the simulation in real time. It is often more important to be able to access the data produced by the simulation and to discover logic defects in the design or the sequence of events. A continuous dynamic simulation performs numerical solution of differential-algebraic equations or differential equations either partial or ordinary. Periodically, the simulation program solves all the equations and uses the numbers to change the state and output of the simulation. Applications include flight simulators, construction and management simulation games , chemical process modeling , and simulations of electrical circuits. Originally, these kinds of simulations were actually implemented on analog computers , where the differential equations could be represented directly by various electrical components such as op-amps. By the late s, however, most "analog" simulations were run on conventional digital computers that emulate the behavior of an analog computer. A special type of discrete simulation that does not rely on a model with an underlying equation, but can nonetheless be represented formally, is agent-based simulation. Distributed models run on a network of interconnected computers, possibly through the Internet. Simulations dispersed across multiple host computers like this are often referred to as "distributed simulations". Visualization[ edit ] Formerly, the output data from a computer simulation was sometimes presented in a table or a matrix showing how data were affected by numerous changes in the simulation parameters. The use of the matrix format was related to traditional use of the matrix concept in mathematical models. However, psychologists and others noted that humans could quickly perceive trends by looking at graphs or even moving-images or motion-pictures generated from the data, as displayed by computer-generated-imagery CGI animation. Although observers could not necessarily read out numbers or quote math formulas, from observing a moving weather chart they might be able to predict events and "see that rain was headed their way" much faster than by scanning tables of rain-cloud coordinates. Such intense graphical displays, which transcended the world of numbers and formulae, sometimes also led to output that lacked a coordinate grid or omitted timestamps, as if straying too far from numeric data displays. Similarly, CGI computer simulations of CAT scans can simulate how a tumor might shrink or change during an extended period of medical treatment, presenting the passage of time as a spinning view of the visible human head, as the tumor changes. Other applications of CGI computer simulations are being developed to graphically display large amounts of data, in motion, as changes occur during a simulation run. Computer simulation in science[ edit ] Computer simulation of the process of osmosis Generic examples of types of computer simulations in science, which are derived from an underlying mathematical description: Phenomena in this category include genetic drift , biochemical [12] or gene regulatory networks with small numbers of molecules. Specific examples of computer simulations follow: This technique was developed for thermal pollution forecasting. Environmental Protection Agency for river water quality forecasting. One-, two- and three-dimensional models are used. A one-dimensional model might simulate the effects of water hammer in a pipe. A two-dimensional model might be used to simulate the drag forces on the cross-section of an aeroplane wing. A three-dimensional simulation might estimate the heating and cooling requirements of a large building. An understanding of statistical thermodynamic molecular theory is fundamental to the appreciation of molecular solutions. Development of the Potential Distribution Theorem PDT allows this complex subject to be simplified to down-to-earth presentations of molecular theory. Notable, and sometimes controversial, computer simulations used in science include: In social sciences, computer simulation is an integral component of the five angles of analysis fostered by the data percolation methodology, [15] which also includes qualitative and quantitative methods, reviews of the literature including scholarly , and interviews with experts, and which forms an extension of data triangulation. Simulation environments for physics and engineering[ edit ] Graphical environments to design simulations have been developed. Special care was taken to handle events situations in which the simulation equations are not valid and have to be changed. The open project Open Source Physics was started to develop reusable libraries for simulations in Java , together with Easy Java Simulations , a complete graphical environment that generates code based on these libraries. Simulation environments for linguistics[ edit ] Taiwanese Tone Group Parser [16] is a simulator of Taiwanese tone sandhi acquisition. In practical, the method using linguistic theory to implement the Taiwanese tone group parser is a way to apply knowledge engineering technique to build the experiment environment of computer simulation for language acquisition. Computer simulation in practical contexts[ edit ] Computer simulations are used in a wide variety of practical contexts, such as:

## 5: Fishwick, Simulation Model Design and Execution: Building Digital Worlds | Pearson

*Model Building & Consulting. FlexSim provides a whole range of model building services, from as-needed consultation where you do most of the work, to partial model building where we can provide a piece of your overall model, all the way through complete system simulations.*

## 6: Create a Simple Model - MATLAB & Simulink

*Building Simulation:An International Journal publishes original, high quality, peer-reviewed research papers and review articles dealing with modeling and simulation of buildings including their systems.*

## 7: Home | Building Simulation Rome

*tation (see Modeling & Simulation Coordination Office ()) is the official certification (by the project spon- sor) that a simulation model is acceptable for a specific.*

## 8: Reservoir simulation models in production forecasting -

*Process of building a computer model, and the interplay between experiment, simulation, and theory. Computer simulation is the reproduction of the behavior of a system using a computer to simulate the outcomes of a mathematical model associated with said system.*

## 9: Computer simulation - Wikipedia

*Energy-modeling is the virtual or computerized simulation of a building/complex that focuses on energy consumption, utility bills, and life cycle costs of various energy related items such as air conditioning, lights, and hot water.*

# SIMULATION MODEL BUILDING pdf

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