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THE UTILIZATION OF COMPUTER SIMULATION AT MACHINING PROCESS OPTIMIZATION IN ENGINEERING INDUSTRY

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Abstract: *The article presents analyse of computer simulations problem in real computing, short wiev of computer simulation models, summary of the mathematics models used at computer simulation, determination process at simulation methods selection, real applying and utilization at machine industry, contribution of analyse in machine industry.*
Key words: *computer simulation, computer model, optimisation, and machine industry*

1. INTRODUCTION

The computer simulation or computer model is the computer program that tries to simulate the abstract model of particular system. The computer simulation becomes useful part in many scientific sections of physics, chemistry, biology, and at not least line the computer simulation becomes indispensable part of science engineering.

The traditional way of the system modelling is by the help of mathematic model, together with the experiment to find the analytic solution of the problem. This model allows to foreseeable behaviour of simulating system from the enter parameters and beginning conditions to the implicit finishing. The modern systems – mathematics models include the possibility of calculating with the ahead undefined enters, it means they allow to simulate vacant enters.

2. MODELS OF COMPUTER SIMULATION

The computer models are sorted by the different criteria:

- **Stochastic** or **deterministic** principle (special case of deterministic principle – chaotic)
- **Continuous** or **discreet** (and very important case of discreet principle, discreet event or DE model)
- **Local** or **distributive**

Stochastic model uses random number generator for the modelling of contingent. This model is called too - Monte Carlo methods.

Discreet model (discrete event simulation DE) operate event in time. Most of all computer tests and simulations is such this type of model. In this type of simulation, simulator operate front of events that are ordered by the time in which they have been simulated. The simulator reads the data from the front and continues so long as the all events are not running. It is not important to simulate, initialise the events in real time. More important is having the data access, which individual events turned out. These data serve for logical error detection in the proposal of our model, or in the link-up false of individual events.

Continuous model uses differential comparing based on the numbers. This model browses all simulation state in regular interval and the result formulates as stages difference of number. Returned value of this type of simulation is differences file, which is numerical presented. A lot of air and automobile simulators are based on this type of simulation. This type is also used on the simulation of electric distribution. Originally was this type of simulation used and applicated in the analogue computers. On the fig.1 is illustrated the real utilization of continuous simulation in ATLAS programme.

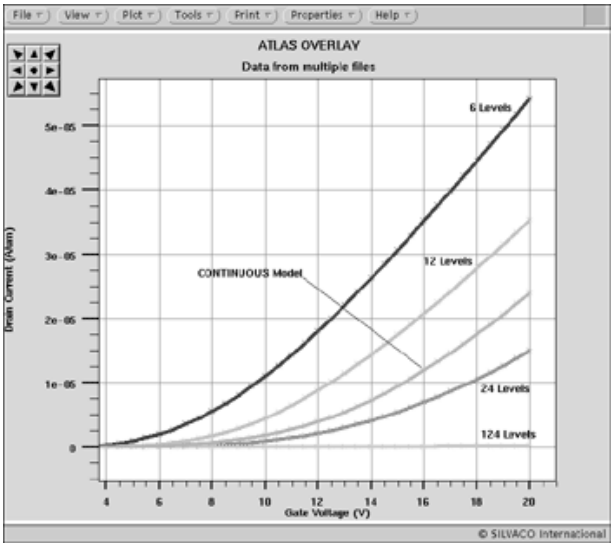

Fig. 1. The real utilization of continuous simulation in program ATLAS

Special type of ***discreet*** simulation, that is not based on the model with fundamental equation but all the same can be formal represented as *agent* simulation. In this type of simulation individual entities (for example as molecules, cellules) are represented directly (rather as their density and concentration), keep their internal statue and set up form and rules how individual agent has passes step by step. The utilization of discreet simulations in practice by the surface tension analyses solving is displayed on figure 2.

Distributed model runs on the net of connected computers, can be through the Internet. Simulations dispersed by several computers are always called distributed simulation. There do exist few military standard for distributed simulation (Aggregate Level Simulation Protocol ALSP, Distributed Interactive Simulation DIS, High Level Architecture HLA).

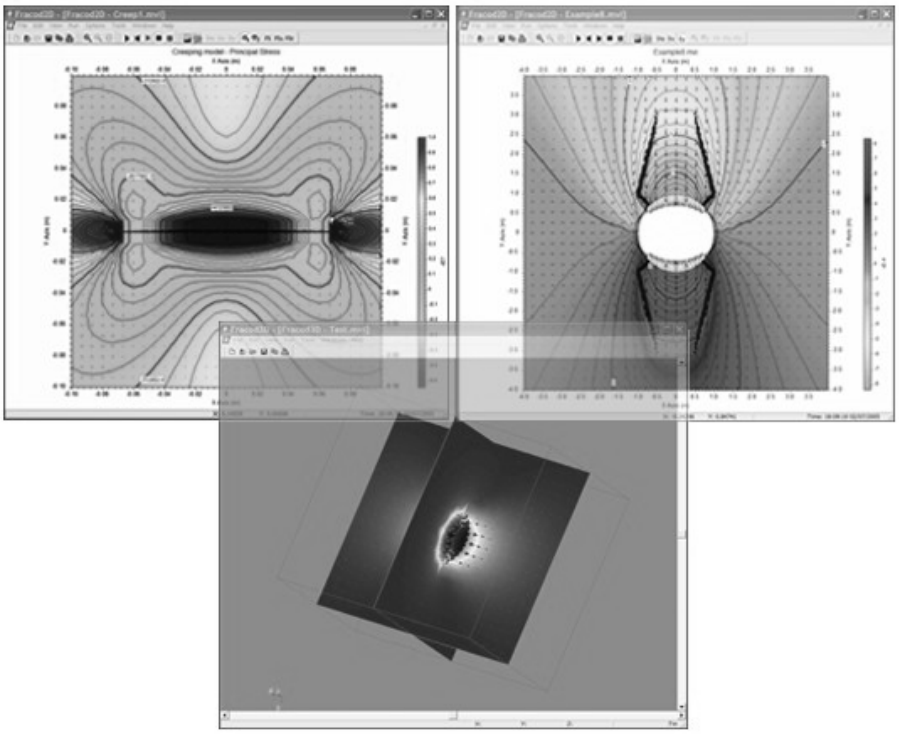

Fig.2 The utilization of discreet simulations in practice by the solving of surface tension analyses

The basic conceptions used in simulation

Entities - elements, those cross through system (parts, documents, customers, messages, reports and so on). Entities are generally characterized so called attributes, which bring themselves- e.g. dimensions, price, priority, statue and so on.

Activities – activities that are made in the system – e.g. truck embarkment, turning, parts verification, machine reparation and so on. Each activity is usually characterized by the time (on the activity preparation and accomplishment), and useful sources (machine, worker, tools and so on).

Controls – the rules that describes how, when and where are performed individual activities and by what conditions the individual events in system can turn up. On the high level of the control is concerned mainly about production plans and schemes, production processes, revision plans etc. On the level of the individual production equipments is concerned about control algorithms described mainly production equipments, goal searching for transporters, control of rack interpolator, robot control and so on. In the simulation systems the individual controls are released by the entities passing through the system – at enter to source or at exit out of source.

3. SIMULATIONS AND PRACTICE

3.1. Why is important to simulate

By the projection and service of the complex logistic and production systems rise many problems and risks. At a classic tools a big number of the variants and complicacy of their evaluating give no choice of optimal solution neither programmer nor directive worker. It is concerned about local optimisation effect, that are occurred not only in service of logistic and

production systems but at their project too. Mentioned problem is extra complicated and it means that we must discuss about optimisation not only from the level of production system or workshop, but from the view of the whole corporational goal too. Currently happen that these systems are projected on the base of narrow view and criteria. If the project is very expensive, there are made edits for its possible realisation. At the indetermination of future requirements on the production, at the time pressure, financial limit and nonavailability of modern projected tools is only very serious to discuss about general optimisation of system parameters. It happen often, that already in the system project are insufficient, that can't allow to full utilisation of all their possibilities. During the service is necessary to solve the problems of added system arrangement. It is usually connected with the next expense increase. For the solution of the mentioned problems are very suitable the computer simulation.

At some area are the simulation experiments necessary from the next reasons:

- The experiment of the simulation is less financial demanding as the real experiment
- The real experiment is not practicable (from the view of the technological possibilities)-original of the simulated system doesn't exist or is not available (the simulation of process in the outer space.
- The real experiment are not ethics (nuclear weapon)
- The employers are training at this additional situations simulating and are training their reactions on these situations too (nuclear reactors, air simulators..)
- Analytic model solution is for mathematics exacting unknown or inadequate sophisticated

3.2 Creation phases of simulation system

At the creation of simulation system are mainly applying these phases:

- Monitoring of original (real) system
- Description of system activities- creation of model, diagrams, equations, choice of relevant quantity, choice of important parameters..
- Formal system description including these quantities
- Proposal of simulation program
- Debuggion and verification of programm,testing **o**f well-known and easy analyse situations
- Simulation experiments with complicated situations
- Application of results

Simulation is research method, that incumbent on supplying the searching dynamic system by simulator, and all tests are made with the goal to obtain the information about the primary-real searching system

3.3 The proposal of simulation program

At the creation of simulation program the programmer must solves the problem how to look at the next important attributes:

- Data structures representing the state of system
- Operators, representing changes of states
- Time in model (so-called similar time)
- The synchronisation of state changes

4. REAL SIMULATION SETTING IN MACHINE INDUSTRY

From the mentioned views have computer simulation for real setting incalculable meaning in machine industry.Some of the processes in machine production are so expensive that their real testing is unimanigable or testing in real time is not possible.

4.1 Utilisation of simulation in machining process

There are many possibilities of utilisation of computer simulation in practise but next will be mentioned only the area of utilization intra chip machining. On the fig.3 is describes the illustration of chip machining simulation.

To the process of cutting operation extend several aspects and enters:

- *Material of workpiece*
- *Material of tool*
- *The type of machining:* **a, direction of workpiece motion** (clock wise (CW), counter - clock wise (CCW), movable motion

  b, direction of tool motion (clock wise(CW),counter –clock wise (CCW),movable motion - as counter workpiece motion, at motion direction..)
- *Temperature of tool*
- *Temperature of workpiece*
- *Consistence of system*
- *Geometry tool*

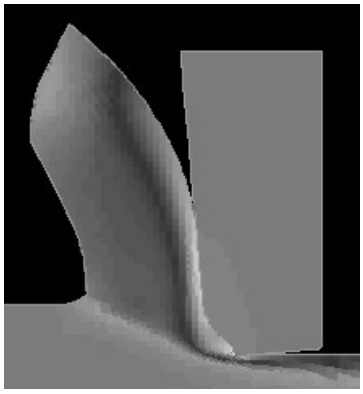

Fig.3. Illustration of chip machining simulation

Enters that interfere and influence the process of machining is essentially more. Mentioned enters serve as illustration, what and in which quantity is necessary to cover up to the mathematics simulation model.

5. CONCLUSIONS

Definite answer on question if to use simulation and what brings to the production process doesn't exists.

Every one who decides to place simulation to the production process should to look over following and on base of this decide:

- What require as the output
- Which enters can put to the simulation
- Ability to save required computing potential (hardware)
- Use existing simulating software
- Develop own single-purpose software for exist job analysis
- Ability to safe enter costs
- Economical benefit

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