NUMERICAL MODELING AND SIMULATION IN VARIOUS PROCESSES

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Abstract

The modeling and simulating of the economic processes is situated at the border of mathematics and technique of calculation. It deals with the substantiation of the managerial decision with efficiency for the producer, with the help of some flexible economic-mathematics models; they also offer the possibility of using the simulation technique.

The economic modeling offers the manager the rigorous side of his actions, multiple chances in order to connect existing resources with the objectives pursued for a certain period of time, offering the possibility of a better and faster thinking and deciding process, without deforming the reality.

Keywords: *modeling, simulation, economic processes*

JEL Classification: C63

Introduction

The purpose of the paper is to present the possibility of using the web services in multiple applications, stressing the advantages brought by this technology. The first part describes the technology and then we expose a series of possible flexible scenarios, which detail the functioning way and the response time.

The distributed systems generally are rich in structured knowledge, not so complex and do not imply behavioral relations among users.

The application is oriented on many different types of users (managers, economics analysts, specialists in informatics, specialists in mathematics, specialists in physics and simulations); it can be used as a working tool in studies of analyses based on numerical values, resulted from questionnaires, case studies.

It is recommended against other applications due to its possibility to be accessed online by many users simultaneously, that can receive the results in the real time. The application contains a multitude of functions from which the users choose only the necessary ones.

The efficiency of the accessible research platforms via web technologies can be proved, taking into account the following factors:
  – instructors: the capacity of implying users, the degree of knowing the application;

– the computers network: hardware performances, transfer speed, the functioning state;
– the used platform: a facile usage both for instructors and for users, reducing the errors at a minimum number;
– the content in the digital format: the scientific accuracy, the attractiveness, the interactivity, attribute which determines the users to remain connected and scan the contents.

The components use standardized interfaces and have a high level of self protection, because the component part subsequent way of usage cannot be anticipated once with its creation.

In distributed applications, the objects state represents a critic element. The distributed components contain distributed objects. The role of the distributed objects is presented furthermore. The concept of distributed objects is referring to existing objects in a different space addresses and whose methods can be appealed by remote methods.

The specific activity for distributed systems development stands for projecting the system architecture, dividing the responsibilities between the system components and placing them on the network computers. The most known and used architecture is the model client/server, but there are also: supplying services on many servers, proxy servers, caching technique, pair processes and others.

Analyzing these architecture models after their functioning principle, we can make a comparison among them. The tasks are better divided into client process and server process, by changing messages in order to fulfill an activity. The set of objects which a service is based on can be partitioned and distributed on many servers. The cache technique is used largely in practice activities, the web browsers keep for every client a cache with the most recent visited pages and other web resources; they use a special HTTP request through which it is verified if the cache pages correspond with the original ones on the server.

Literature review

Currently the information society is a kind of information society in which the production and consumption is the most important type of activity. Information is recognized as the main source for information technology and communications, which are the basic technologies, and environmental information with social and ecological environment as a human environment. Also with the transition to an information society, a new distributed system is widely used; it facilitates the access to a wide variety of resources. Resources can be computers, storage, network links, software, etc.

These themes were approached by many specialists, each of them contributing to the field development with specific concepts and researches. For a general view, we studied the most recent ones. As the modeling is concerned, the solutions are to be found in Abdul A. R. and Pilouk M. works (Abdul & Pilouk,

2008); the usage of the web services was focused by Hansen M.D., referring especially at SOA (Hansen M.D., 2007); for the Ajax technology a useful guide is the work of Holdener A.T. (Holdener A.T., 2008); for practical applications oriented toward businesses and not only, the main work is that of Iyengar A., Jessani V., Chilanti M., *WebSphere Business integration Primer, Process Server, BPEL, SCA and SOA* (Iyengar A., Jessani V., Chilanti M., 2008).

Theoretical background

The simulation (Abdul & Pilouk, 2008, p. 109-120) is a technique of realizing the experiments with the numeric calculator, which implies the construction of some mathematical and logical models that can describe the behavior of a real system for a longer period of time. The simulation (Hansen, 2007, pp. 340-349) is an efficient research technique for the complex economic problems at a firm level, impossible to be studied in an analytic manner. Within the simulation activity, there are implied three important elements, namely: the real system / the model / the computer and two types of relations: modeling and simulating relations.

"The real system" represents the system felt with our senses. "The real model" represents the real system replaced which corresponds to the requirements of the initial real system. "The abstract model" realizes the passing from the "real system" to "the real model". It reproduces the real system through the decomposing of the real system into elementary component parts and establishes the connections between them.

The numerical methods of calculation are practical, efficient and elegant (Abdul & Pilouk, 2008, p. 130-135), the achievement of a own web architecture will contribute significantly to this.

There are seven groups of elementary structures: vectors and matrices, algebraic evaluations, linear algebra, analytical evaluations, analytical problems, special functions, approaching and interpolation.

The digital technologies introduced on the market by the Web technology; this completely fulfils all the requests connected with the information cost, stocking and spreading (Couluoris, 2001, p. 29-61). From this first steps where the sites were simple visiting cards, iterative processes have been created and developed. At the same time with the transition to an informational society, a novelty is represented by the distributed systems of big dimensions, which facilitates the access to a great variety of resources (Holdener, 2008, p. 22-34).

In the following study, I will use the book Numerical Library in Java for Scientists and Engineers. It offers for each subject a general discussion, a certain amount of mathematical analysis (Hansen, 2007, p. 329-332), a certain discussion of algorithm and the most important, the implementation of these ideas in a real mode, as routines. There is a proper equilibrium among these ingredients for each subject.

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Each group was analyzed. Based on these analyzes we conducted a series of scenarios useful in process simulation. Such a scenario is presented in figure below:

The resolving of the parabolic and hyperbolic equations (using the function **Ark**):
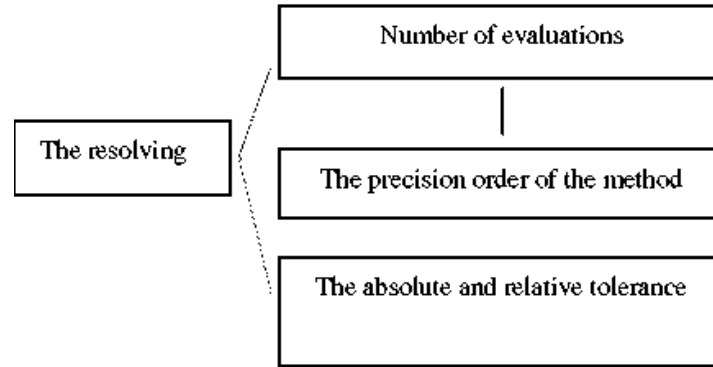

Fig 1. *The graphic representation of the scenario for the resolving of the parabolic and hyperbolic equations*

Used procedures:
 a) the initialization of a vector after certain constants;
 b) vectors with multiple setting forms;
 c) factors for multiplication;
 d) duplicate elements in a vector;
 e) the product of an element belonging to a vector and other element belonging to another vector;
 f) adding a multiple constant from a vector to other element from another vector being in a certain state;
 g) the resolving of the systems of linear equations.

This creates scenarios for each group and for each function of the group. Test results were so encouraging and conclusions that can be drawn after the realization and use of these scenarios are stated below:
 a) the possibility of resolving problems of great dimensions which do not go in the client computer memory;
 b) the identification of the common costs;
 c) the reducing of the costs;
 d) the reducing of the response time;
 e) the client can be involved in the problem description.

The computer's simulations seem to be the most efficient methods of using the computers in economics. The contribution of economic science to society development is essential. The great discoveries were realized with empirical

methods, but nowadays the technology of the information, which seems to be one of the most efficient methods, is used not only in economics, but also in other research fields. The created web service connects the informatics technology with the economics.

Methods and techniques

From the multitude of methods, we firstly refer to the method of the analysis of the critic way which detaches of all of them. It handles the arbitrators with useful tools for analyzing, organizing and ruling of the complex actions; it marks out the place of the decisional activity within the assembly of the complex action.

The mathematical logic introduces and uses logic forms and calculations in order to deduce the rules of the correct thinking and their application for constructing correct reasoning. (Hochgurtel B., 2003, p. 92-115).
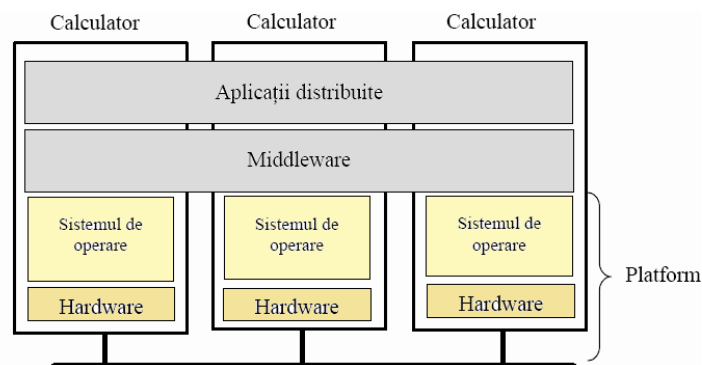
The passing from an interface of the type line command with the user, to an interface based on the web services represents a great advantage because it allows the combination and the usage of some procedures – routines – prior defined.

These characteristics and the projection aspects of the distributed systems can be described as descriptive models (Hurwitz & Bloor & Baroudi & Kaufman, 2007, p. 20-25).

Each and every model will represent an abstract, simplified but consistent description of the relevant aspects of the distributed systems.

For these, the hardware component is important, but the software has a determinant role.

The most known structure is the hierarchical structure on modules. The following figure shows the general structure (Abdul & Pilouk, 2008, p. 25-107) of a distributed system.

Source: http://koolkampus.com/engineering-notes-1/information-technology/software-concepts-middleware/

Fig 2. *The general structure of a distributed system*

In order to exemplify this, we present the Efrk function (Hang. T. L., 2004, p. 483-492). Thus, we can determine the minimum of the respective function. The function service is created on the Eclipse platform and it is realized in Java language.
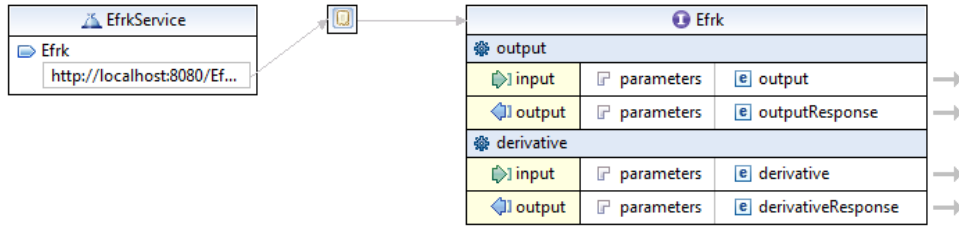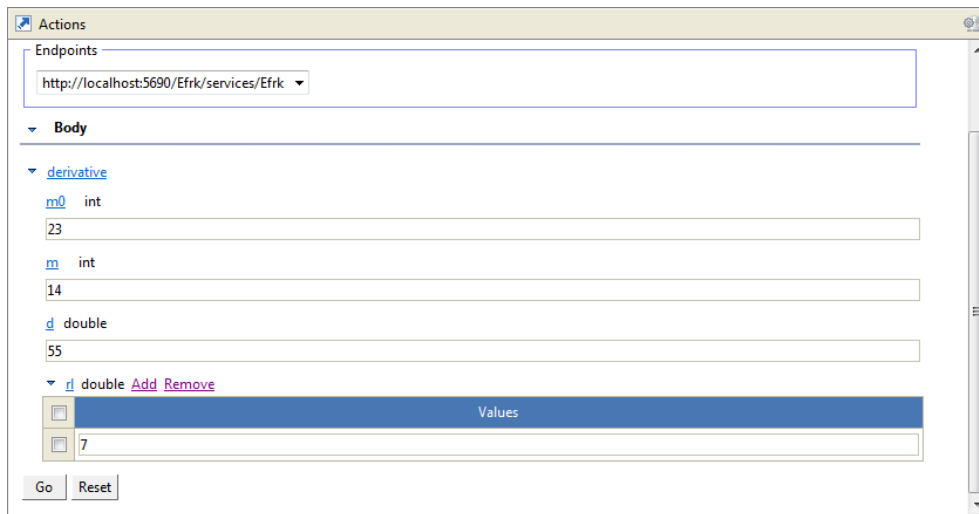

Fig. 3. *Efrk WSDL*

Fig. 4. *The launching of the web service for Efrk function*

Fig. 5. *The response time for Efrk function*

By respecting and adapting the design of these types of functions and mathematical calculation, any process can be adapted for virtually each formula, using both as distributed systems and Web services based on numerical calculation.

Conclusions

Process simulation is an area with great potential, both for development and scientific studies. They involve a number of issues and roles. The subject interests large categories of scientific preoccupations. The economic modeling offers the manager "the rule of managing", multiple possibilities to correlate the existent resources with the aimed objectives for a certain period of time.

Mathematical modeling of this aspect of the decision is made by numerical calculation that is application adapted.

The advantages this method brings to the users consist in: the possibility the user has to use them again within other applications; the shape reconfiguration depending on the case study; the reduction of the time and implied cost; the possibility of a simultaneous usage by several users at the same time, all of them receiving the responses required in a real time.

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