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A Graphics Generator for Physics Research

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1. Introduction

The great quantity of information which emerges from the necessity of an informational society can be mastered in a proper way, due to the perfection of the informatics systems used in all the fields. The pieces of information, due to the fact that they are numerous as concerns their content, become hard to work with, on the whole; thus, only a part of the content is represented as compound and flexible objects, by assuring both their direct usage and re-usage within other conditions and situations. An important factor in the trend of spreading and adapting the application on the web zone is represented by distributed systems and web services.

Generally speaking, the administration of resources and fluxes in distributed systems of great dimensions are confronted with many difficulties. These are provoked by the complexity of the hardware and software platforms and, especially, by the dynamism which is characteristic of these systems' compounds.

These drawbacks can be met through two necessary conditions, based on the understanding of the performing characteristics of the resources of administration systems and of the delivery solutions for a better dynamic adaptation.

This chapter proposes to demonstrate the utility of distributed systems in the design of educational and research software in physics. Educational systems are generally rich in structured knowledge, but not so complex, which does not imply behavioural relations among users.

However, all of the existing architectures being their construction with the experts in the experience of the learning domain, but not from the user's perception, as well as from the study of the materials of the way one constructs the schemes of mental concepts' (Hansen, 2007). One has to underline that there is an intrinsic connection between the results obtained by the users and the method of teaching. Due to the restriction imposed by time and resources, the great part of the implementation is reduced to simple models of knowledge. Thus, the present educational systems do not propose to determine the real state of knowledge, and so the strategies used by the users are omitted as are the specific strategies for each and every domain.

2. Theoretical background

Because of problem which one follows wants to develop consists in realizing web services with numerical calculating methods, I provide a presentation of some points of view connected to the subject. The basic standards, originally proposed by IBM, Microsoft, HP and others, are: SOAP (Simple Object Access Protocol), which offers a standard modality of connecting to the web, UDDI (Universal Description, Discovery and Integration), which represents a standard modality of issuing one's own web services, and WSDL (Web Service Description Language), which provides further information for understanding and using the offered services (Landau 2008). WSIF (Web Services Invocation Framework) represents the invoking of the web services, defined by the standards WSDL and UDDI (Universal Resource Locator). This kind of invoking does not suppose the creation of SOAP XML messages. There are four kinds of transmitting an invoking: one-way - the final point receives an answer; request-answer - the final point receives a message and transmits a correlated message; solicitation-response - the final point transmits a message and receives a correlated message; notification - the final point transmits a message. The most used are one-way and request-answer. The location transparency is realized through link patterns, as a UDDI type. The web services revolute the way in which one application communicates with other applications, thus offering a universal pattern of data which can easily be adapted or transformed. Based on XML, the web services can communicate with platforms and different operating systems, irrespective of the programming language used for their writing. For easy communication among the business parameters: the Java language allows the applications' realization regardless of the platform used. The apparition of the Web services represents a means of communication on a large scale. This can be done by applying some standardized protocols, defined by standardized public organizations. The basic protocols of the Web service are not complete as regards the description and implementer terms, their security, reliability and complexity. It is known that by the fact of using Web technology, the information uses many sources. The portal is the mediator for the access to the information. The portal servers are, in their turn, elementary components in the interchange of information. The importance of these technologies is due to the fact that they emerged as a response to the present tendencies manifested in the software industry: distributed remaking, the development of applications based on the components, the development of the services for companies and the modifying of the Web paradigm, in the sense of the development of applications.

3. Services for numerical calculation

The purpose of the present study is the analysis of the surplus introduced by the Web service interface and its exposure in as simple as possible a variant of the facilities introduced by it. The study uses the book *Numerical Library in Java for Scientists and Engineers*, and so the present work does not re-implement the codes in that book, but only uses those already implemented. The passing from an interface with the user in a command line to an interface based on Web services represents a big advantage because it allows the combining and re-using of some procedures with a prior definition. Many discussions about the algorithms in the speciality literature on the Web omit important details, which can only be uncovered by encoding or be made suitable by reading the code. We also need the real code for object-oriented programming, found in the *Numerical Library in Java for Scientists*

and Engineers (Lau, 2004). An orientation of these solutions is for scientific explanations which are based on numerical calculation, beginning with elementary structures, progressing to complicated ones, as the integration of ordinary differential equations (Lau, 2004). The digital technologies introduced to the market include Web technology; this completely fulfils all of the requests connected with the information cost, stocking and spreading (Petcu, 2008). From these first steps where the sites were using simple visiting cards, iterative processes have been created and developed. Once, with the movement towards an informational society, a novelty is represented by the distributed systems of large dimensions, by which facility is enabled access to a great variety of resources. The above mentioned book offers a general discussion for each subject, a certain amount of mathematical analysis (IBM, 2009), a certain discussion of the algorithm and, most importantly, the implementation of these ideas in a real mode as routines. There is a proper equilibrium among these ingredients for each subject. A starting point is concerned with the construction of the services and the inclusion of one or more methods in implementation is constituted by the analysis of the data structures from the elementary to the complex (Isbasoiu, 2009). The majority of the books on numerical analysis use a specific subject "standard", such as: linear equations, interpolation, extrapolation and ordinary differential equations. Other discussed points are: the functions' evaluation and especially mathematical functions, aleatory numbers, the Monte Carlo method, sorting, optimization, multidimensional methods, the Fourier transformation, the spectral methods and other methods concerning statistical descriptions and data modelling and relaxing methods. The book (Lau, 2004) says that there are seven groups of themes that should be focused on: vectors and matrices, algebraic evaluations, linear algebra, analytical evaluations, analytical problems, special functions, proximity and interpolation. Each group has the name Basic followed by the appropriate number for each theme. A schematic representation of these groupings is presented in Figure 1 (Isbasoiu, 2009):

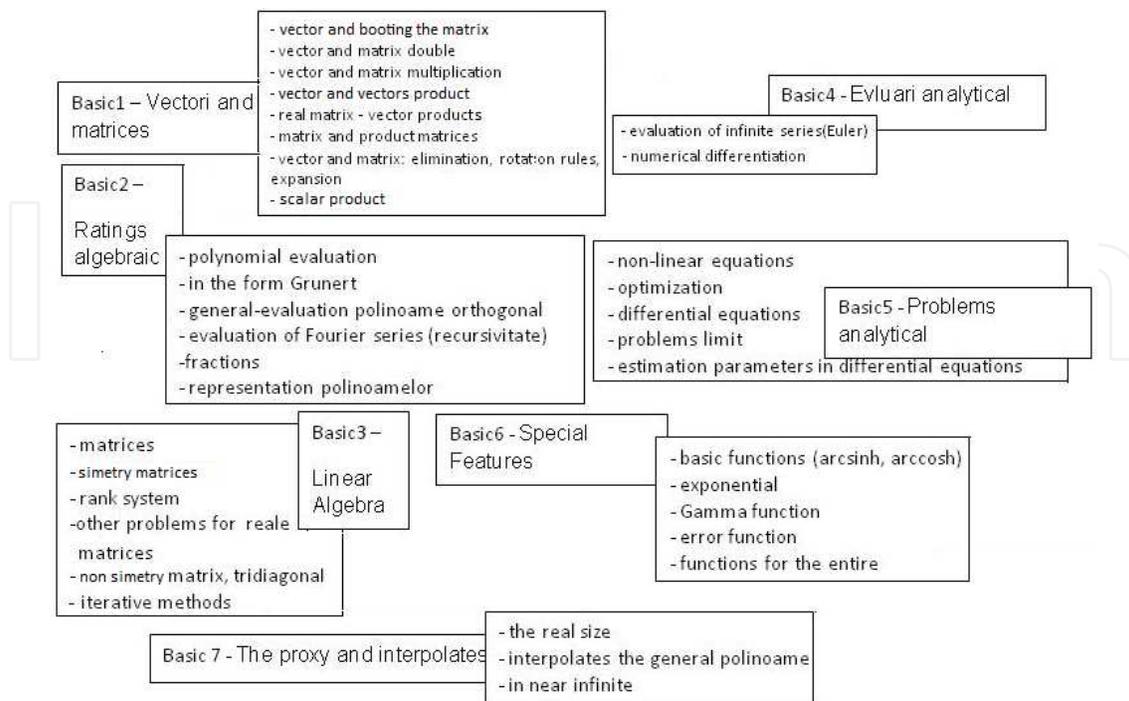


Fig. 1. The basic grouping

Every group contains an impressive number of functions. Through an attentive analysis, we noticed the following: Basic 1 is the base for the construction of the other basics, and some functions of Basic 1 are applied even with the construction of the other functions of this basic; every basic interacts with the other basics; there are functions which do not interact or else do not represent the basis for the construction of other functions. In trying to conclude all of these representations in one, it appears in the following figure:

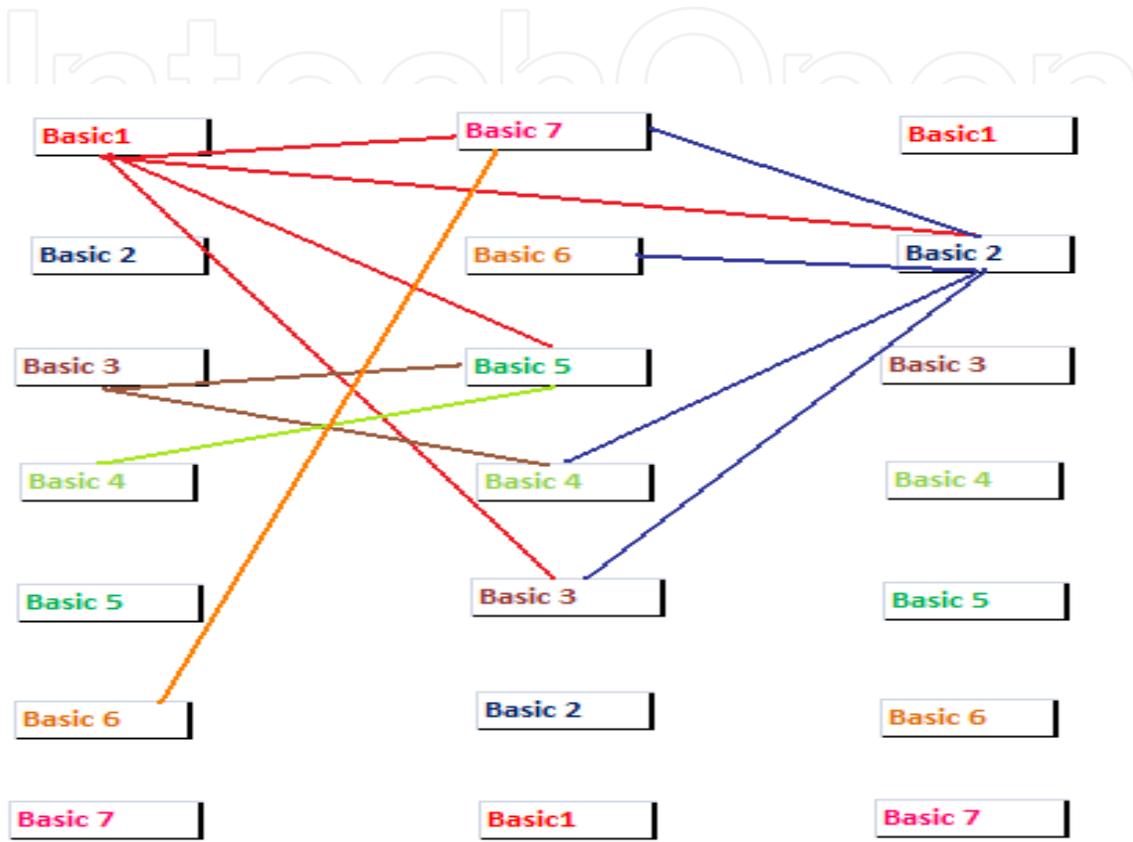


Fig. 2. All dependencies' representations

In the following table is presented the number of times a function is used by other functions:

	Basic 2	Basic 3	Basic 4	Basic 5	Basic 6	Basic 7
Basic 7						
Basic 6						1
Basic 5				1		
Basic 4				1		
Basic 3			2	14		
Basic 2		1	3		4	1
Basic 1	1	77		20		2

Table 1. The dependencies' representation

A graphic representation of these dependencies, depending on the number of functions that appear, is realized as follows:

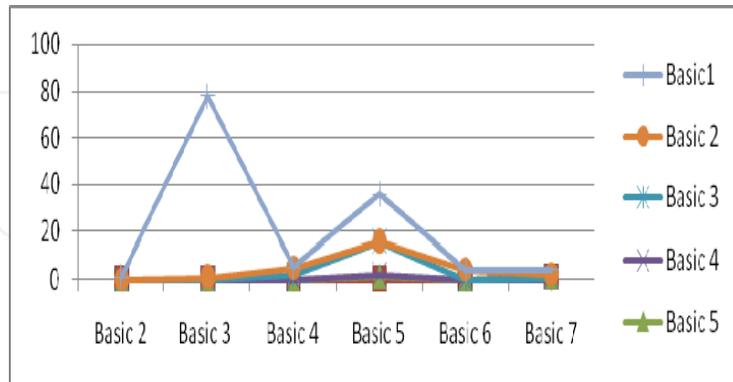


Fig. 3. The graphical representation of the dependencies according to the number of functions

3.1 The functions for numeric calculation – Time comparison

The services were realized using the Eclipse platform. For each function, the response time is specified. We can notice that it varies a lot. We repeat the measurements for more complex input data, both for double type and integer type and vectors and matrices because these units of time depend on this input data.

Function Name	Time of response with Web Service (val/ms) -simple values	Time of response with Web Service (val/ms)-complex values	Function Name
Rnk1min	16	143	Rnk1min
Praxis	11	580	Praxis
Marquardt	13	541	Marquardt
Gssnewton	14	642	Gssnewton
Multistep	10	533	Multistep
Ark	15	570	Ark
Efrk	13	13	Efrk
Efsirk	561	616	Efsirk
Liniger1vs	456	603	Liniger1vs
Liniger 2	473	583	Liniger 2
Gms	605	470	Gms
Impex	562	524	Impex
Peide	628	587	Peide
Minmaxpol	611	552	Minmaxpol

Table 2. Time of response for every function with the Web Service

An elegant graphical representation of the response variations can be seen in the following graphic:

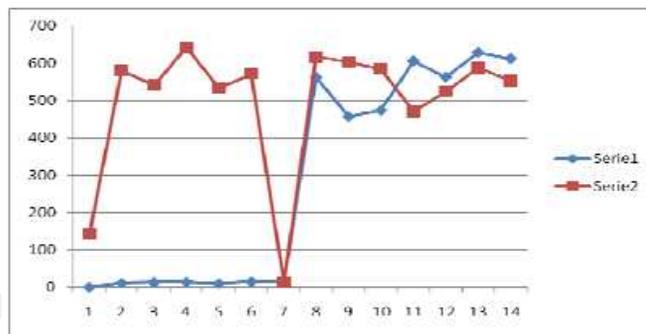


Fig. 4. Graphical representation of the response variations for every function

We repeat the measurements, without the Web Service, for more complex input data, both for double type and integer type and vectors and matrices, because these units of time depend on this input data.

Function Name	Time of response without Web Service (val/ms) - simple values	Time of response without Web Service (val/ms) - complex values	Function Name
Rnk1min	10	36	Rnk1min
Praxis	8	368	Praxis
Marquardt	9	336	Marquardt
Gssnewton	7	398	Gssnewton
Multistep	8	327	Multistep
Ark	11	352	Ark
Efrk	10	7	Efrk
Efsirk	314	326	Efsirk
Liniger1vs	289	318	Liniger1vs
Liniger 2	293	359	Liniger 2
Gms	348	236	Gms
Impex	311	312	Impex
Peide	362	362	Peide
Minmaxpol	353	342	Minmaxpol

Table 3. Time of response for every function without the Web Service

A more elegant representation of time variation can be seen in the following graphic:

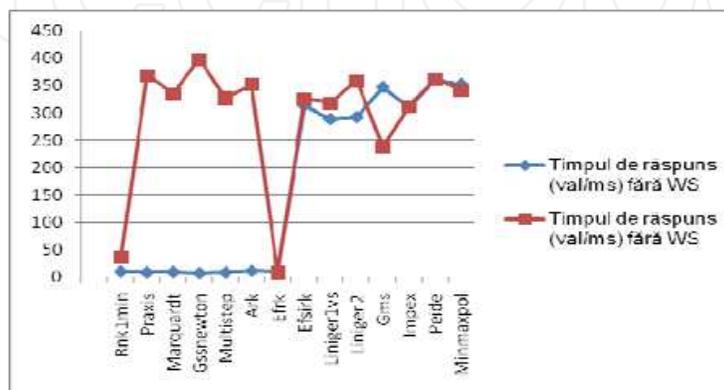


Fig. 5. The graphical representation of time response of each function

In analysing with a focus on the two graphics (Fig. 3 and Fig. 4), we can notice the following:

- generally, the response times are longer for complex parameters, the main cause stands for the value itself of those parameters
- the longest time belongs to those functions which resolve determinants, matrices and vectors
- there are extremely close response times for some functions
- we can see two groups of functions, corresponding to two types of functions
- it is clear that the only function which does not modify its time is Efrk, having the value of 13 ms - with the Web Service
- irrespective of the type of data introduced - or of their complexity - the response time is bigger, but still close
- by comparing the bits of response time with the Web Service there are significant differences, so with this case it is important to consider the complexity of the input data

3.2 Scenarios

The evaluation of a function and the discovery of its minimum (using the function Rnk1min)

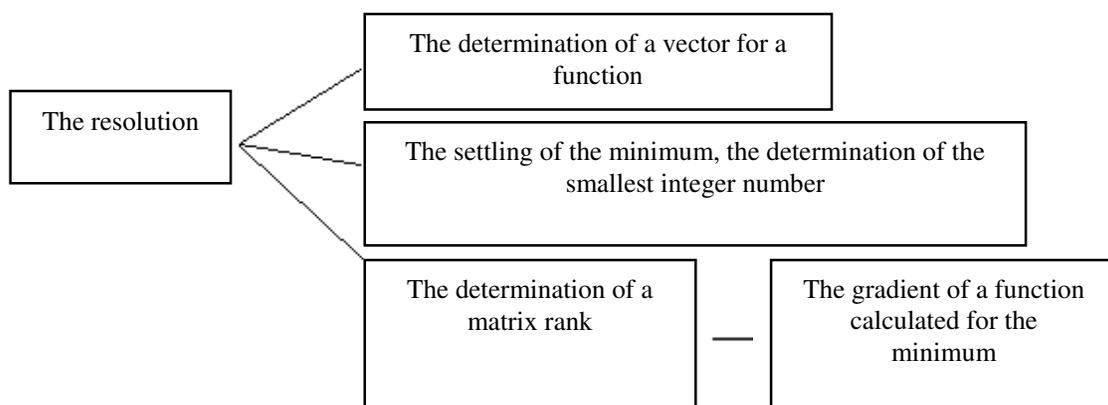


Fig. 6. The graphical representation of a scenario for the evaluation of a function and the discovery of its minimum

Procedures used: vectors product, the determination of a superior triangle matrix.

The determination of the minimum of a function with a minimum number of searches (using the function Praxis):

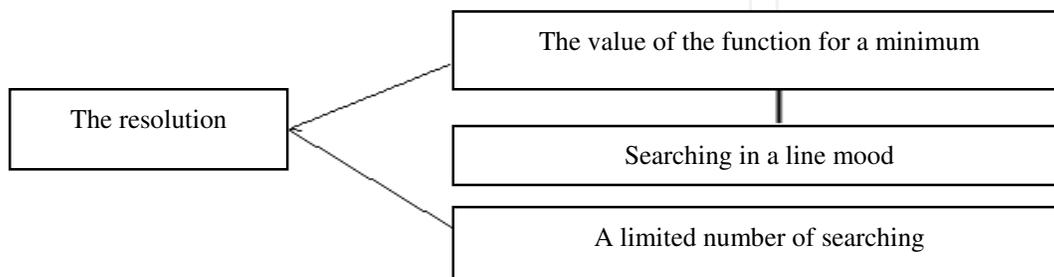


Fig. 7. The graphical representation of the scenario for the determination of the minimum of a function with a minimum number of searches

Procedures used: initialization of the constants, initialization of the sub matrices, matrices' product, matrices' rank.

The resolution [L1] of a non-linear system (using the function Marquardt)

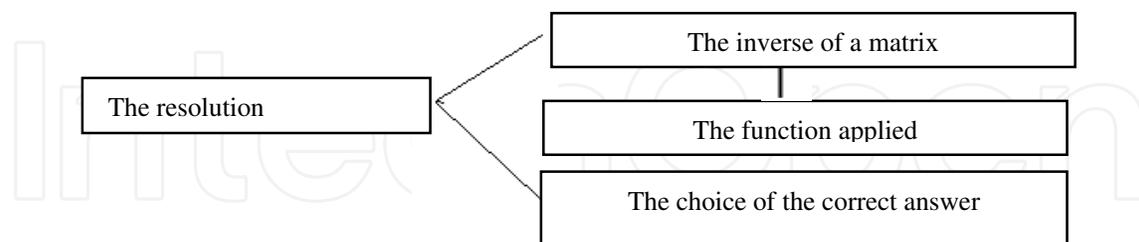


Fig. 8. The graphical representation of the resolution of a non-linear system

Procedures used: the product of two vectors, the product of a vector and a matrix.

The determination of the solutions of a non-linear system (using the function Gssnewton)

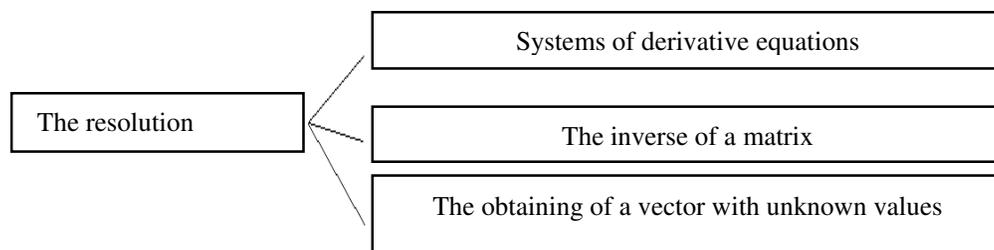


Fig. 9. The graphical representation for the determination of the solutions of a non-linear system

Procedures used: pivot method, the resolution of the systems through successive appeals, the interchanging of lines and columns for the inversion of a matrix, the product of two vectors, adding a multiple constant, systems with the same matrix coefficient, resolved through successive appeals.

The resolution of the systems with differential equations (using the function Multistep)

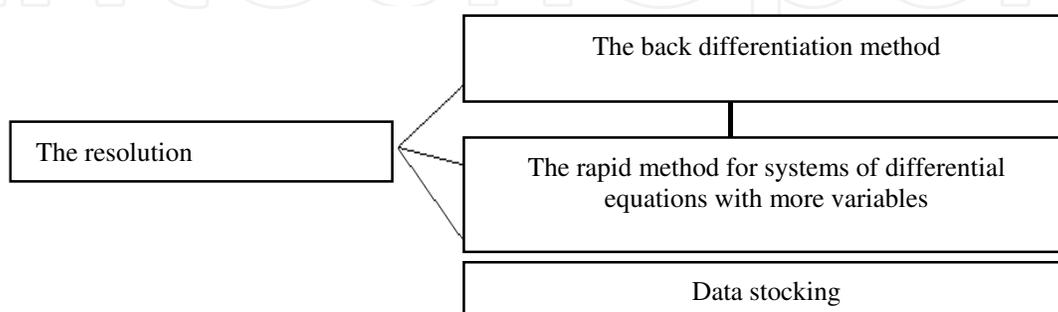


Fig. 10. The graphical representation of the scenario for the resolution of systems with differential equations

Procedures used: the product of two vectors, the product of a vector and a matrix, matrices decomposition, particular cases: a smaller number of variables as against the number of binary numbers in the number of representation, the resolution of the linear systems whose matrix was distorted triangularly.

The resolution of the parabolic and hyperbolic equations (using the function Ark)

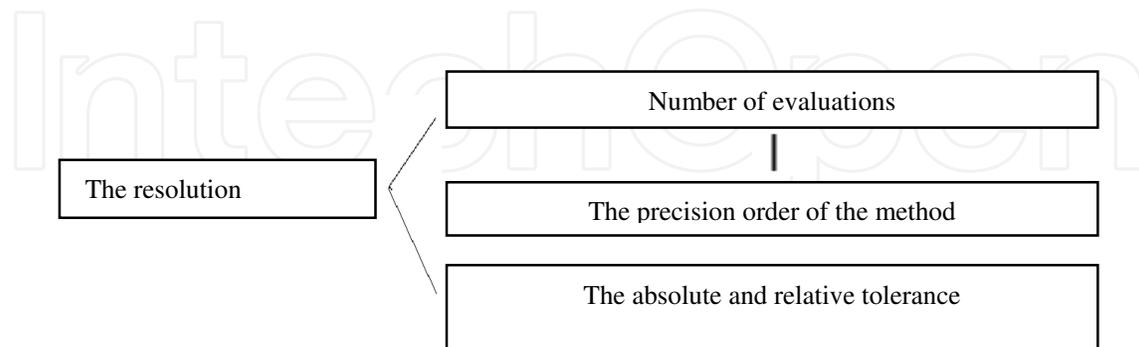


Fig. 11. The graphic representation of the scenario for the resolution of parabolic and hyperbolic equations

Procedures used: the initialization of a vector after certain constants, vectors with multiple setting forms, factors for multiplication, duplicate elements in a vector, the product of an element belonging to a vector and other elements belonging to another vector, adding a multiple constant from a vector to other elements from another vector being in a certain state, the resolution of the systems of linear equations

The resolution of the systems with ordinary differential equations (using the function Efrk)

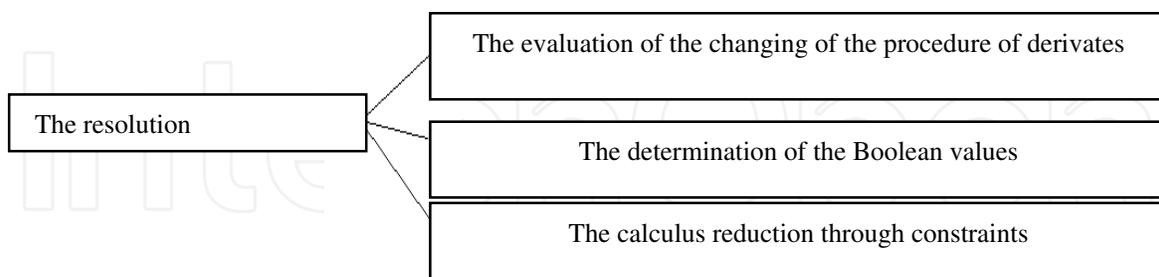


Fig. 12. The graphical representation of the scenario for the resolution of the systems with ordinary differential equations

Procedures used: adding a multiple constant from a vector to an element belonging to another vector which is in a certain state, matrices decomposition, permuting, resolution linear systems.

Resolution the autonomous systems of differential equations (using the function Efsirk)

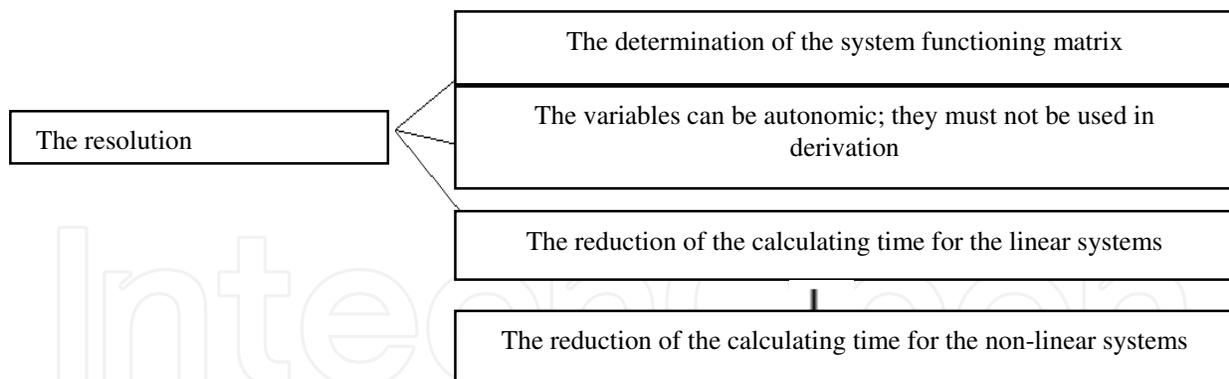


Fig. 13. The graphical representation of the scenario for the resolution of the autonomous systems of differential equations

Procedures used: the product of an element of a vector and another element of another vector, the product of a vector and a matrix, the product of a vector represented by the index of a row and a matrix represented by the index of a column, matrices decomposition, permuting, the use of the partial pivot, factors for multiplication, decomposition of the linear system as the matrices type.

The resolution of the autonomous systems for differential equations (using the function Liniger1vs)

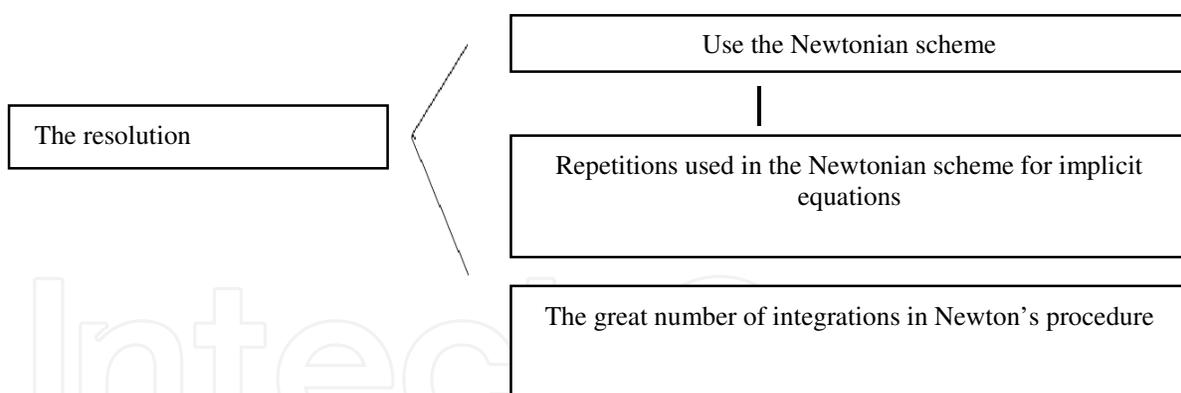


Fig. 14. The graphical representation of the scenario for the resolution of the autonomous systems for differential equations

Procedures used: the initialization of the matrices and constants, factor of multiplication, replacement the elements of a matrix with a succession of elements in a rectangular matrix, duplication of an element in a vector, the product of a vector and a matrix, adding a multiple constant, the product of two vectors, matrix decomposition, permutation of matrices, resolution the linear systems.

The resolution of the autonomous systems for differential equations (using the function Liniger2)

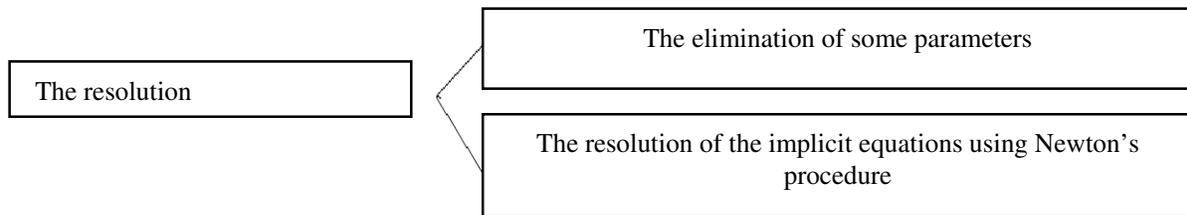


Fig. 15. The graphical representation of the scenario for the resolution of the autonomous systems for differential equations

Procedures used: the product of an element of a vector and another element of another vector, the product of a vector and a matrix, the product of a matrix line and the column of another matrix, matrices decomposition, permuting, the resolution of the linear systems.

The determination of the number of differential equations (using the function Gms)

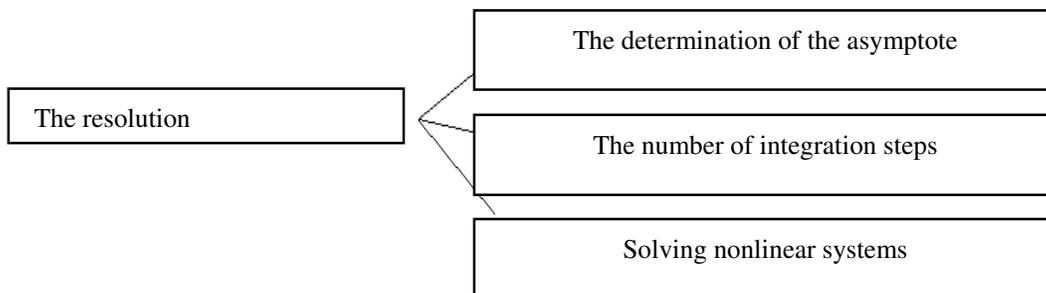


Fig. 16. The graphical representation of the scenario for the determination of the number of differential equations

Procedures used: the product of a vector and another vector, the product of a line in a matrix and a column in another matrix, adding a multiple constant, the resolution of the linear systems, the replacement of a matrix column with constant complex elements and factors of multiplication.

The determination of the number of differential equations (using the function Impex)

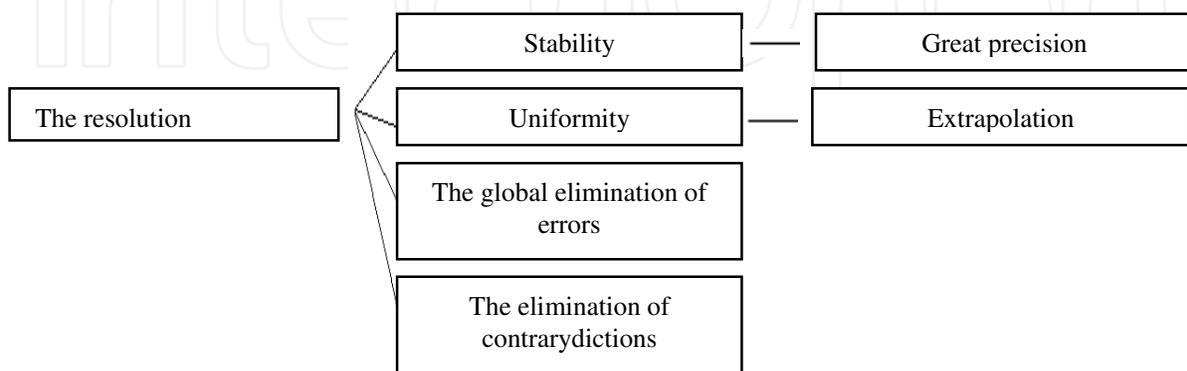


Fig. 17. The graphical representation of the scenario for the determination of the number of differential equations

Procedures used: the initializing of the matrices and constants, the initializing of a sub matrix, the replacement of an element in a vector, the replacement of a column in a matrix with complex constant elements, the product of an element of a vector and another element of other vector, the product of a vector and a matrix, the product of a line in a matrix and the column of another matrix, matrices decomposition, permuting, resolution the linear systems.

Estimations on the unknown variables (using the function Peide)

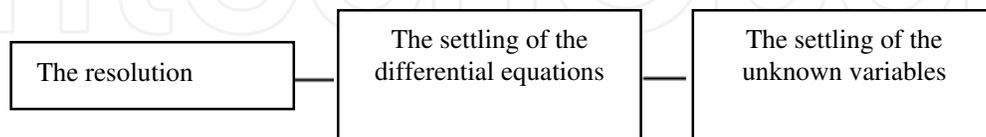


Fig. 18. The graphical representation of the scenario for the estimations on the unknown variables

Procedures used: initializing of the matrices and constants, initializing of a sub-matrix, factor of multiplication, replacement of an element in a vector, replacement of a column in a matrix with complex constant elements, the product of an element of a vector and another element of another vector, the product of a vector and a matrix, the product of a line in a matrix and the column of another matrix, matrix decomposition, permuting, resolution the linear systems, the maximum number of repetitions to be made.

Calculating the polynomial coefficients (using the function Minmaxpol)

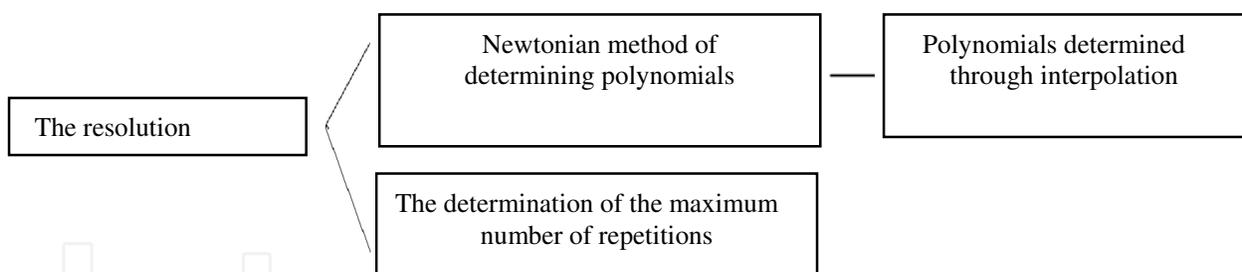


Fig. 19. The graphical representation of the scenario for the calculating polynomial coefficients

Procedures used: adding a multiple constant from a vector into another vector, the duplicate settling of an element of a vector, calculating the Newtonian polynomial coefficients obtained through the interpolation of the corresponding coefficients, calculating the polynomial sum, determination of the polynomial degree.

3.3 Tests realized on the basis of the scenario

I realized a series of tests on the basis of these scenarios. I calculated the sum, the subtraction, the product, the division, the determinant, the inverse, the medium matrices and the covariant, for matrices beginning with 2X2 up to 9X9, both with the Web Service and without the Web Service.

	WS	Con	WS	Con	WS	Con	WS	Con	WS	Con	WS	Con	WS	Con	WS	Con
	2x2	2x2	3x3	3x3	4x4	4x4	5x5	5x5	6x6	6x6	7x7	7x7	8x8	8x8	9x9	9x9
Sum 1	124	31760	155	63933	293	104647	317	118323	642	179817	1445	243078	96	286256	-	-
Sum 2	87	32082	122	60776	137	99928	146	112502	188	179686	1517	324743	3160	286083	-	-
Sum 3	89	29685	117	64181	103	100201	135	114665	213	171903	217	379526	263	371584	-	-
Subtraction 1	56	31719	116	63946	128	100474	138	117425	190	180489	210	366958	259	280512	-	-
Subtraction 2	55	32245	173	56843	791	100124	905	114534	1013	179535	1390	364693	2512	285700	-	-
Product	63	31372	167	55817	173	99639	247	116339	426	192731	504	356460	8477	399901	-	-
Division	62	31922	173	62806	118	91329	1420	119942	200	183242	1668	360198	428	416070	-	-
Transposed 1	4	28385	69	48881	91	87872	124	118044	168	180539	5777	352467	2646	405871	-	-
Transposed 2	50	29611	68	62897	105	91625	1494	114164	2137	183603	3280	467799	4870	510209	-	-
Determinant	31	156	124	286	515	3922	6508	4567	24233	23344	76553	255284	967344	826578	-	-
Inverse	286	34208	468	52574	5670	91807	18898	132468	151344	315996	1048074	2301332	8829661	10053879	-	-
Media	50	5362	61	5016	77	8467	124	11956	9	11921	140	19830	157	124004	-	-
Medium matrix	45	6134	57	10812	66	11434	83	11423	794	19435	116	19838	132	34184	-	-
Covariant	75	29850	139	56160	166	87511	1064	112456	432	172651	1210	380630	698	439619	-	-

- *) Time expressed in micro seconds
- *) WS - Web Service
- *) Con - Executed in console

Table 4. The time obtained with testing

Due to the calculation of the inverse the execution time, beginning with 9x9, is bigger than 30 seconds.

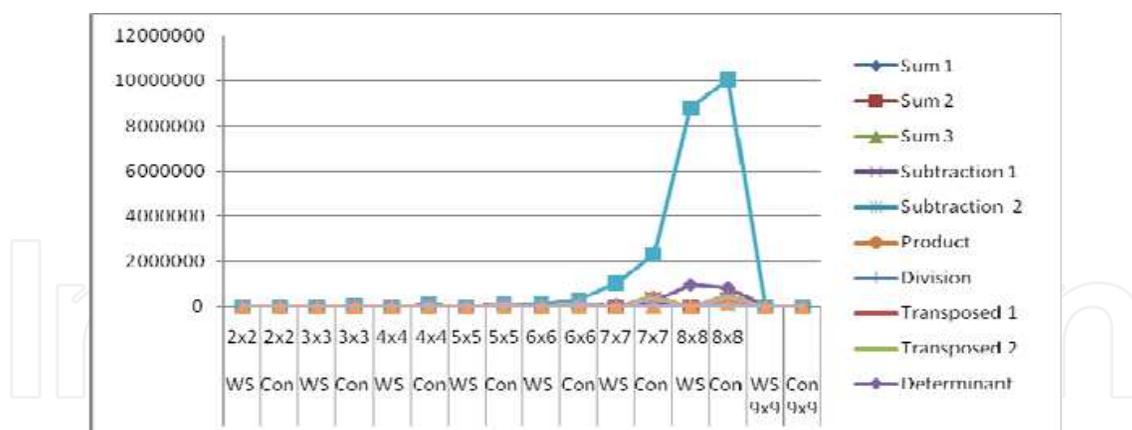


Fig. 20. The graphical representation of the response time for tests, with and without WS

The advantages of the web service use with these scenarios:

- a. the possibility of resolution problems of great dimensions which do not go in the client computer's memory
- b. the identification of the common costs
- c. the reduction of the costs
- d. the reduction of the response time
- e. the client can be involved with the problem description

4. A graphics generator for physics research

The proper architecture for the web service used for physics simulations is divided into a working area. At first, we realized a series of Web services which grounds the numerical calculation. These facts are oriented towards scientific applications, beginning with elementary structures, up to complex ones, such as the integration of ordinary differential equations. The passing from an interface of the type line command with the user, to an interface based on Web services, represents a great advantage because it allows the combination and use of certain procedures - routines - defined earlier on.

The methods for numerical calculation are practical, efficient and elegant, and the realization of a proper architecture of a Web service will significantly contribute to this process [2].

Beginning here, I would like to develop this idea, applying it to both physics and physics research. By selecting this, I chose the most representative phenomena in physics which allow for applications; next, I followed the interpretation of them from the point of view of numerical calculation.

The chosen phenomena are:

- a. A motor with a continuous current;
- b. The forces of inertia on the earth's surface;
- c. The dynamics of a variable mass point;
- d. Admissible resistance;
- e. Floating bodies.

In order to set out every phenomenon, they are described physically and are mentioned in terms of the manner in which they are to be found within the created service. The platform is divided into two parts: the former is designated to numerical calculation; the latter is for the realization of graphics. Also, within this service, there is a static zone where I present the selected physical phenomena, as can be seen in the following image (retrieved on <http://www.eliza-isbasoiu.muscel.ro> 05/10/2009).

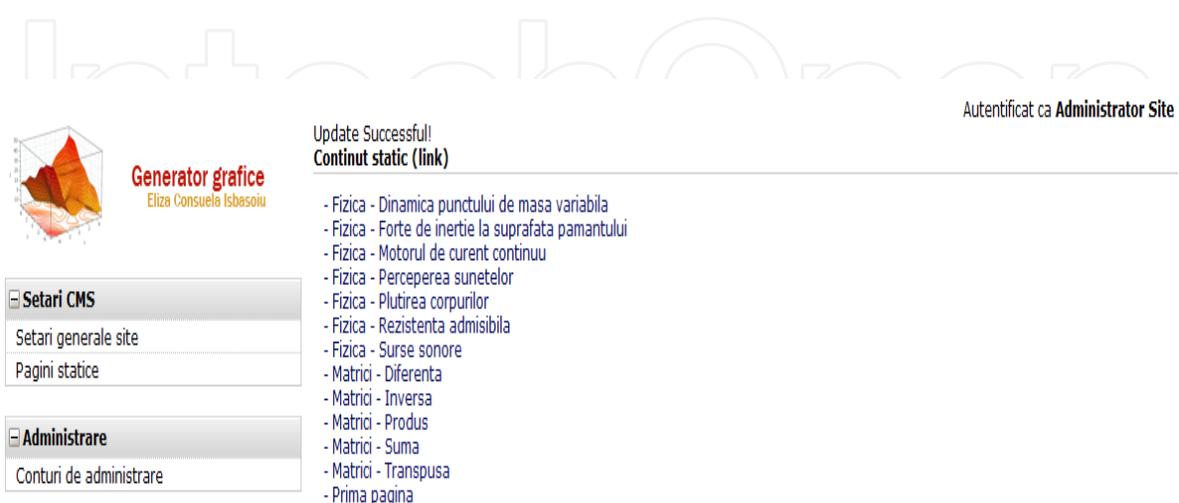


Fig. 21. WS Static content (link-uri)

The user is first welcomed by the image presented beneath: (retrieved on <http://www.eliza-isbasoiu.muscel.ro> 05/10/2009)

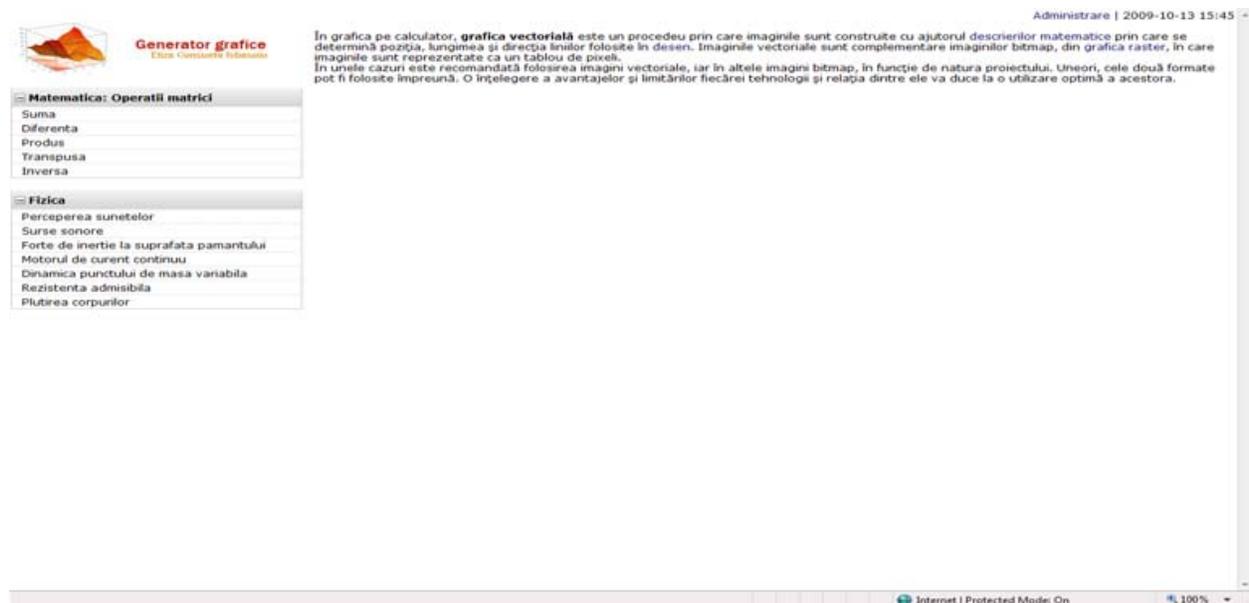


Fig. 22. The starting image of the platform

In order to know the variables of the constants and equations at the basis of every simulation, the user receives pieces of information about the physical phenomena and the possible discussions after the simulation.

A motor with continuous current

One should notice that if we apply a tension to the motor terminals - given the same polarity as where it works as a generator - the rotor spins in the opposite direction as that of the generator (Maxwell, 1892).

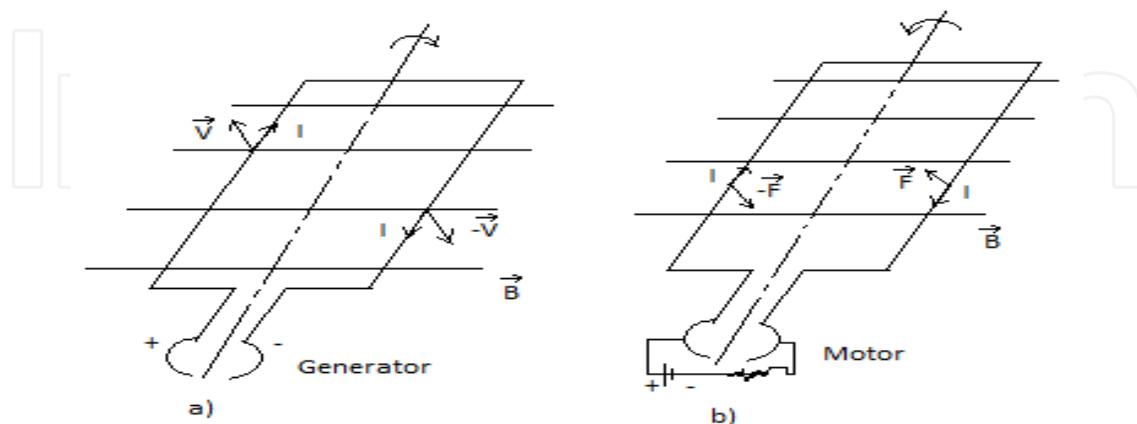


Fig. 23. The graphical representation of the generator and the motor

The parameters that vary are: external voltage, ranging from a minimum value and a maximum, R and r , and contrary [L2] electromotor tension. According to these values, the

graph appears. Such findings may be established for efficiency (retrieved on <http://www.eliza-isbasoiu.muscel.ro> 05/10/2009).

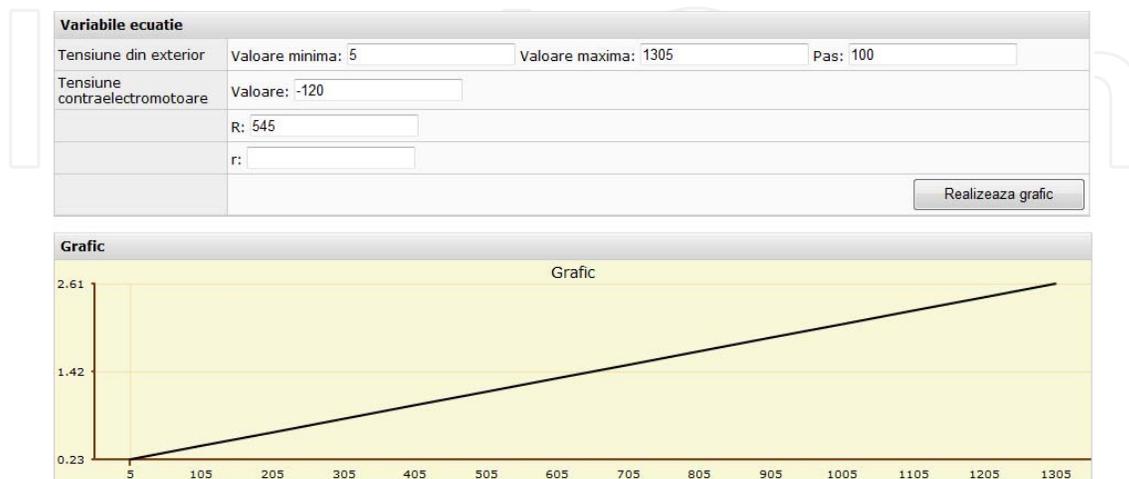


Fig. 24. The graphical representation of the contrary [L3] electromotor tension

Forces of inertia on the earth's surface

The Earth makes a revolutionary motion around the Sun, under the influence of the gravitational forces of different cosmic bodies in our solar system.

We consider a material mass point m , being at rest against the Earth in an A point. This can be seen by the following picture:

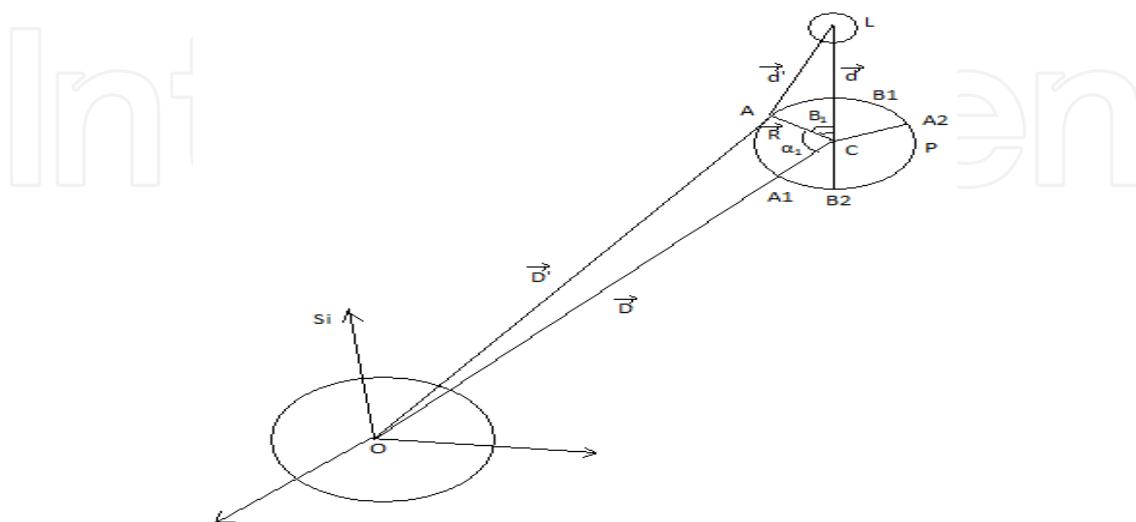


Fig. 25. The graphical representation of the material point as against the Earth

In the inertial system S_i against the material points, thus act the gravitational forces of the Sun, Moon and Earth.

The determination of inertial forces on the earth's surface has been, for a long time, a very attractive notion in physics.

Mass: the point of mass is variable. The angle is also variable. (retrieved on <http://www.eliza-isbasoiu.muscel.ro> 05/10/2009).

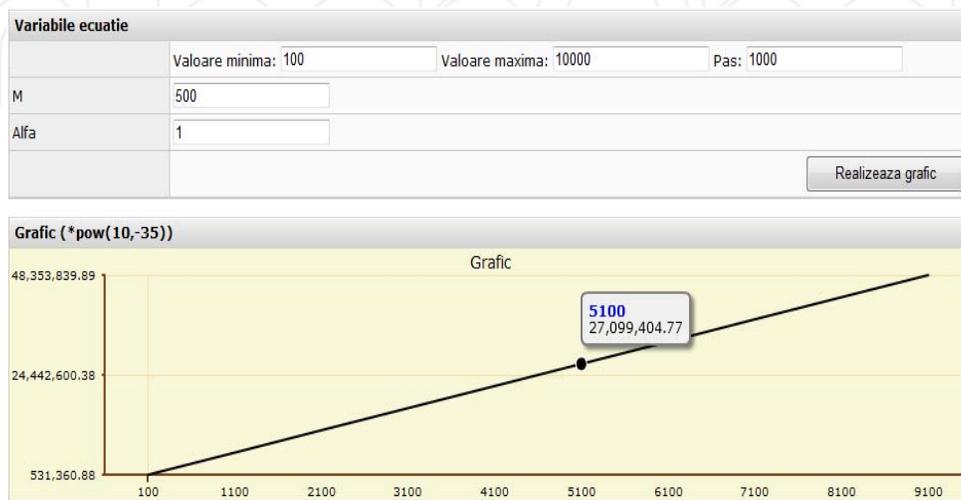


Fig. 26. The graphical representation of the inertial forces on the earth's surface

The dynamics of the variable mass point's applications in the case of detachment.

We consider a material point M , with the mass m , whereby the variability of its mass is given by the joining or detaching of some particles from M . These two situations are, in fact, two cases: the joining case and the detaching case.

The variables in this situation are greater. The time ranges between a maximum and a minimum. The matter the value it receives is v_0 . The angle, the reaction speed and the gravitational acceleration influence the graph (retrieved on <http://www.eliza-isbasoiu.muscel.ro> 05/10/2009).

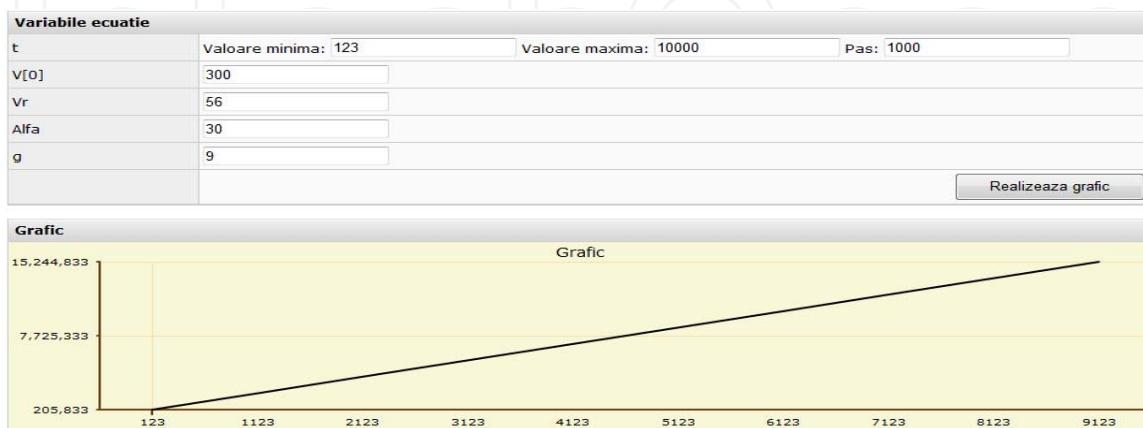


Fig. 27. The graphical representation of a variable mass point speed, after an angle of $\alpha = 30^\circ$

The floating bodies

Knowledge of the conditions which determine the stability of floating bodies is very important in naval construction techniques. We assume a floating body which has a centre in the same place with the O point, as with the figure below, and that over the superior part of the body outside the liquid on which the F horizontal force acts, by tending to turn the body towards the left (Balibar, 2007).

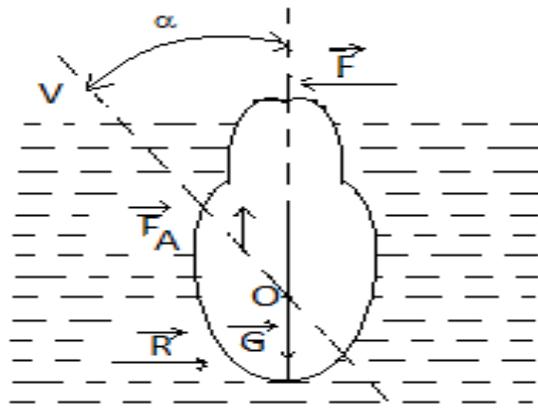


Fig. 28. The graphical representation of the centre of mass an inclined floating body

The factor which influences this phenomenon the most is represented by the surface marked by S. After we introduced the minimum and maximum of the value, we obtained the following graph (retrieved on <http://www.eliza-isbasoiu.muscel.ro> 05/10/2009).

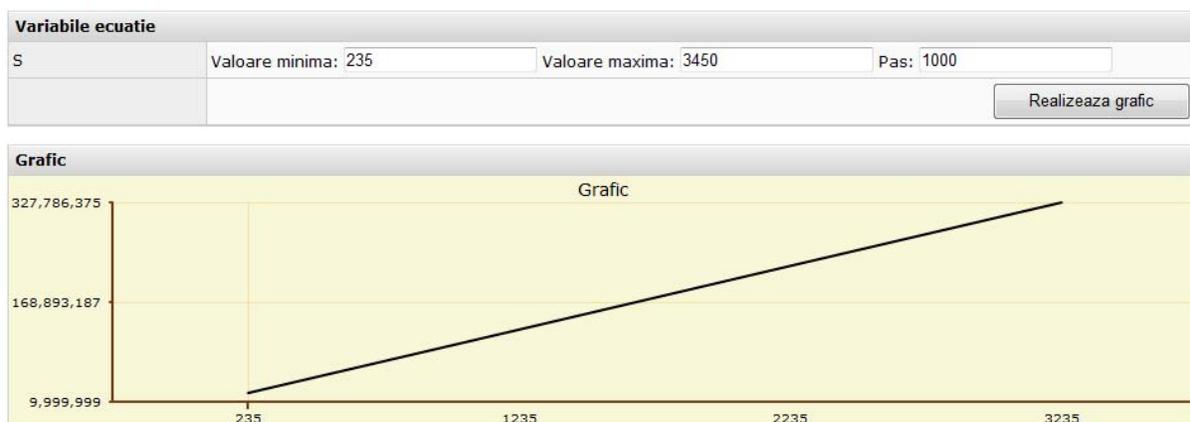


Fig. 29. The graphical representation of the limits between a body can or cannot float for a specific surface S

The graphical interface which the user employs is a simple one but extremely efficient, because it is generalized for every area of study (retrieved on <http://www.eliza-isbasoiu.muscel.ro> 05/10/2009).

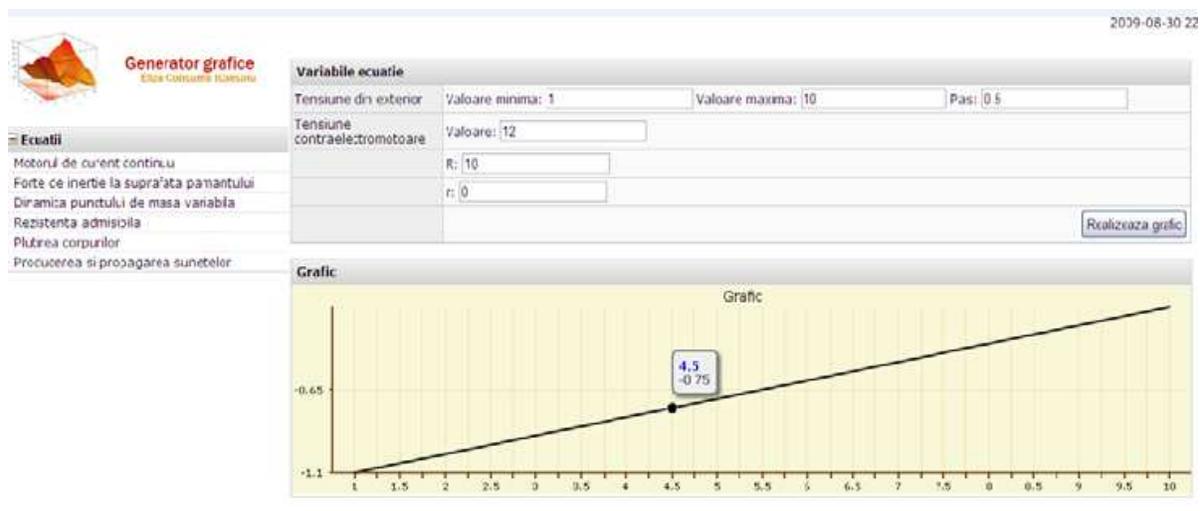


Fig. 30. The image of the graphical interface of the Web service – graphics generator

When we press the button “generate graphs”, the user is asked which essential parameter they want as a graphical representation. For example, for control electromotor tension, there are three variants: the exterior variation of U tension, the variable E contro electromotor tension, the R variable.

The following image presents this fact (retrieved on <http://www.eliza-isbasoiu.muscel.ro> 05/10/2009).



Fig. 31. Select the variant for the graphic

The platform is divided into two working areas: the former is for numerical calculation; the latter is for the graph’s realization.

We can represent the sound's intensity; we introduce two values, the minimum and the maximum, the representation being made after a desired pattern (retrieved on <http://www.eliza-isbasoiu.muscel.ro> 05/10/2009).

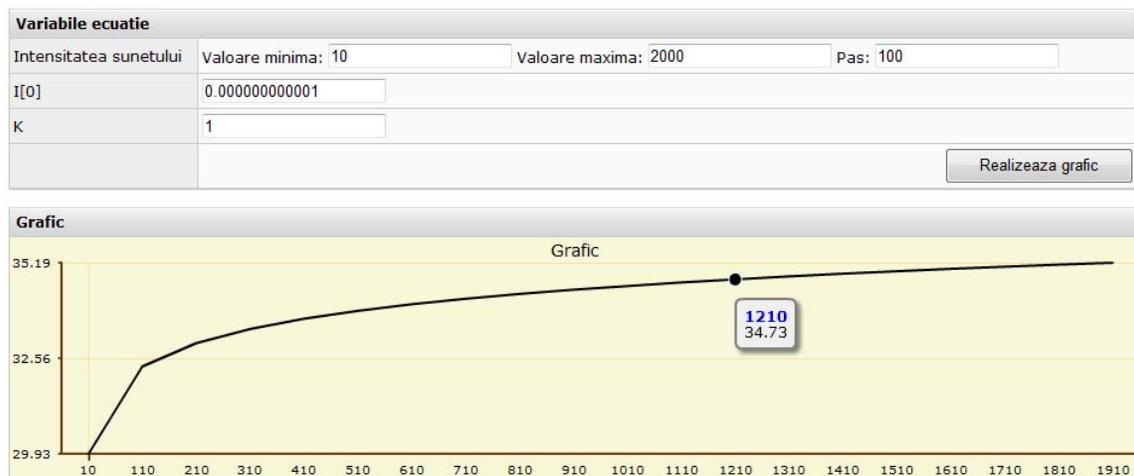


Fig. 32. The graphical representation of the sound's intensity

If we modify the weight, then by increasing it simultaneously with the increasing of the α angle, the graph is as follows: (retrieved on <http://www.eliza-isbasoiu.muscel.ro> 05/10/2009)

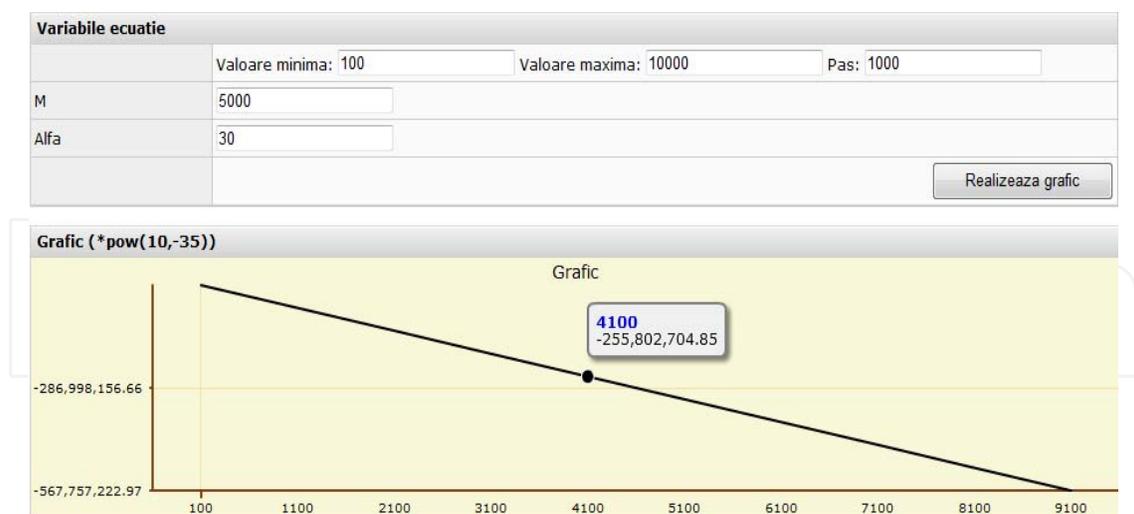


Fig. 33. The graphical representation of the inertial force at the earth surface, for the angle $\alpha = 30^\circ$

The above representations suggest the following conclusions:

- the necessity of knowing of all of the equations, but also the particular cases which represent the basis of the physical phenomena;

- b. the possibility of interpretation, depending upon the input values;
- c. simulations for finding other possible particular cases;
- d. the understanding of the physical phenomena, at a practical level.

All these solutions are oriented towards scientific applications, which are grounded on numerical calculations. They are followed by more complicated constructions.

There are many authors who deeply value such software architectures. Some of them consider it to be the separate profession of the software engineer [5]. Others consider it be independent, separate for the role of the software engineer and, thus, in need separate learning approaches.

The activity can be considered from: psychological points of view; systematic points of view; organizational points of view.

From the psychological point of view, the application is a creative process, which implies knowledge within close fields, such as: software engineering, computer science, logic, cognitive science and programming etc. From systematic point of view, the project is seen as an activity which implies the discovery of optimal solutions for a set of problems, taking into account the balance between obstacles and forces.

The organizational perspective offers the possibility that some software elements are re-used for other products.

The main ideas which result from the above examples are as follows:

- a. the necessity of knowing all of the equations and the particular cases which represent the bases of the physical phenomena;
- b. the possibility of their interpretation depending upon the input data;
- c. simulations for finding other particular cases;
- d. the practical understanding of the phenomena of physics;

All of these comparisons between values and interpretations, based upon the graphs, depend upon users' objectives. It is very important that a possible user of the application can use the interface despite different levels of knowledge. The created Web service presents a few physics applications based upon numerical calculations. The selected phenomena can assure the construction of more complicated applications. This method displays ideal cases which are not present in nature, but also specific cases. If one interprets them correctly, one can find optimal solutions to a set of problems; besides this, there is the possibility of the further use of the results obtained. The main advantages of using the Web service are: the possibility of solving problems of great dimensions which exceed the computer's memory; the identification of common costs and their reduction; the reduction of the time response value; the fact that client can be involved in the problems' description.

The graphic must be defined within the text editor under the form **equation (formula,min,max,step,precision)**.

- a. the formula must be x variable, framed by double inverted commas this 'x'. The x variable must have a space before it and another space after it in an equation, whenever it appears. For example: "sin(x) + cos(x + 4) + 2 * x "
- b. min, max represent the interval margins where the calculation is made;

- c. the step represents the incrementation value of the values for which the calculation was made;
- d. the precision represents the ranging interval of the graphical representation. It is recommended to use 0.01; one can also use other values in order to see the results.

A few examples of graphs generated by this method are presented below: (retrieved on <http://www.eliza-isbasoiu.muscel.ro> 21/10/2010).

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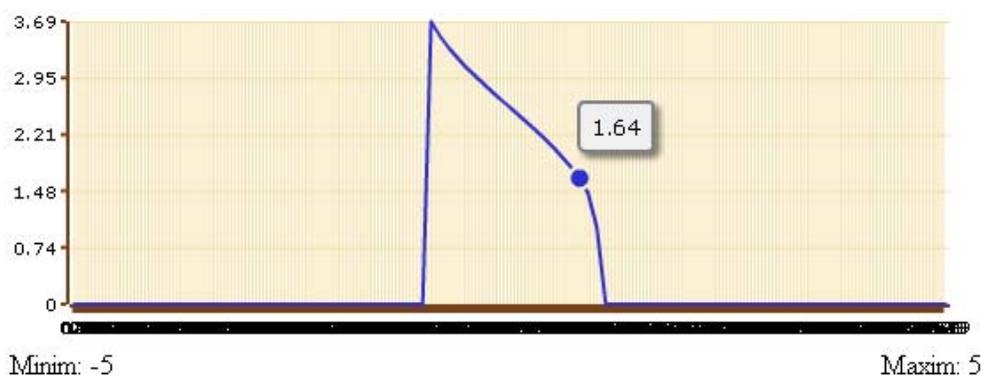


Fig. 34. The movement of a projectile

Figure 32 presents the movement of a projectile according to the equations of the theory depicted in the area “the description of physical phenomenon” (retrieved on <http://www.eliza-isbasoiu.muscel.ro> 21/10/2010).

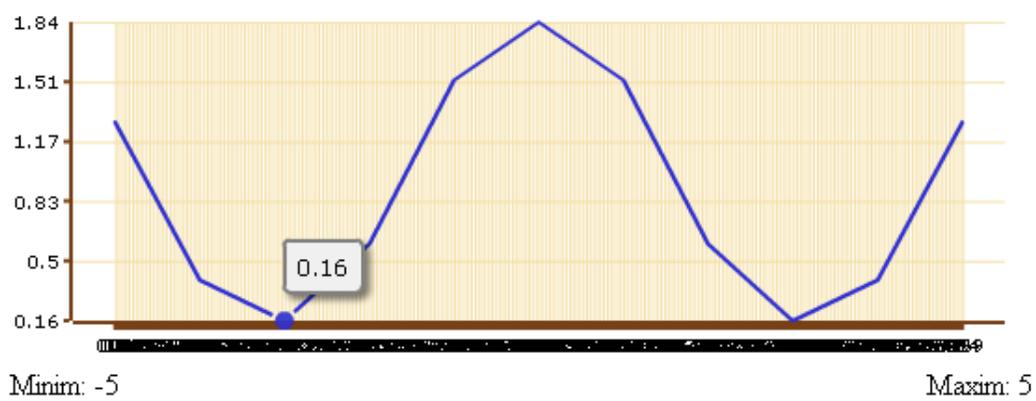


Fig. 35. Newton's Second Law

Figure 33 presents the Second Law of Newton, in conformity with the equations from the theory depicted in the area related to the description of physical phenomena.

5. Conclusion

We presented in this article concepts connected to the architecture of distributed systems, demonstrating the criteria for a proper choice in order to use adequate technology. The problem that we developed was represented by the realization of certain Web Services using methods of numeric calculation. The applications were created on the Eclipse platform; these were realized with the solutions offered by the book *Numerical Library in Java for Scientists and Engineers*. These solutions are oriented towards scientific applications based upon numeric calculation. They begin with elementary structures move on to more complex structures. By grouping and creating services for each and every structure, we realized that many of the functions used for their construction appeal to other functions; we created a table where those functions appear only once. We created a service for every function and followed the response time. We saw that, depending upon the function's complexity, this time differs. By way of comparison, we constructed a graphical representation with the time for both individual functions, with simple input data, and parameters with complex values. The next step would be to realize Web services for education in physics, as well as services for scientific research in physics, using these services.

So long as informatics and communications technology evolve, the implications that they will have on the educational system are difficult to be foresee. There will be always new opportunities and new difficulties, but there will also be results and benefits.

Computer simulations seem to offer the most efficient methods for using computers in physics. There, the processes used in research physics are encouraged: for determining the cause of an effect, in prognosis, and also for the interpretation of research data. As a rule, such simulations develop an inductive and deductive way of thinking, by assuring the capacity of problem solving, the formulation of new hypotheses and the realization of tests. We feel that users should be allowed to realize other experiments as a preliminary to the physics laboratory.

Beginning with these elements and using the Web services for numerical calculation subsequently realized, I selected a series of mathematical functions, namely those useful for the equations used for continuous electricity, the calculation of inertial forces on the earth's surface, the calculation of the dynamics of variable weight points for finding admissible resistance, and in the production and propagation of sounds.

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