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Use of methods for determining the parameters Newton electrical facilities in port sea as factors determining the electricity

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ABSTRACT: Albania is located in a very favourable geographic position in South-Eastern part of the Balkans, the main hub of Corridor 8, where 1/3 of the border sea, about 440 km, which is considered a seaside location, with favourable natural conditions to achieve a qualitative shipping, guaranteed and reliable.

Assessment of pollution in general and those electromagnetic, electrical (wisp currents - stray) in particular, port facilities within the investment is of particular interest.

That's because wisp currents are part of the electrical environment pollution have a significant impact on the performance of machinery and portals equipment, damage to marine resources, damage to marine ecosystems, impact on satellite communication systems, as well as the consequences for the people better life located in these environments.

As the first step of our studies in this field, in the article we have tried to make an describe of the use of Newton's method for determining the electrical parameters of the breakdown in polar coordinates to solve the distribution problem of power flows and voltage marine environments as determinants wisp currents.

As one of the modern methods most powerful in terms of convergence and speed of settlement, implementation found today and the use of the algorithm of Newton's method in most of the distribution of power flow programs, the voltage levels in machinery, nodes, and in different environments.

KEYWORDS: Mathematical modelling, Newton, Power, voltage, currents, wisp currents.

I. INTRODUCTION

The quotation made by William Thomson that: "If we cannot express something in the numerical value, your acquaintances are poor and insufficient", is the motto that has made these last three decades to achieve in the use of mathematics in all fields of science. Considerable progress has been made in the development and use of numerical methods for solving many of the problems are here in electromagnetic fields at high frequencies and low.

These problems are addressed using analytical solutions, but these solutions are limited in the geometric configurations, at a time that many problems are linear. Such configurations can be found in technical applications, but most of electromagnetic devices used today, accompanied by physical problems, that does not have a simple geometry. These cases they can be treated using numerical solution and this is the reason for their use inclusive. This progress was achieved through the achievements in the field of computer development.

The effect of currents wisp is increasing the importance of self, following the trend of creating electromagnetic devices with high power density. This requires engineers extensive knowledge of electromagnetic phenomena when creating and operating these devices, because wisp currents affect us directly so the performance of electrical appliances. This effect may be desirable or not. Therefore, there are devices which are based in developing wisp currents as linear motors or issuer, equipment for creating magnetism, or for generating concentration of high magnetic fields and others.

In such cases, wisp currents are desirable and usable. In other cases, wisp currents are undesirable since it causes Joule losses and should be minimized. In both cases, wisp streams should be described and defined correctly. Defining the wisp currents in a given configuration using numerical solution is the goal of the work of this material. Specifically, methods are available with a criterion of their use. Also, they presented the resolution procedures with some typical applications for each case.

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In this paper we will present the values of these wisp currents of their existence factors and associated thoughts with measures for their minimization, as well as their consequences, are considered important qualities and material selection, electric power machinery and install equipment at these ports. The method of mathematical modelling, using dinators, settles easily, quickly and with high precision calculations of this problem.
The problem of the distribution of powers and tensions determined by the nonlinear system of equations, whose solution requires the use of iterative computational mathematical methods. In our paper we bring mathematical modeling of the factors that determine the value of the planetary currents in order to further determine the factors that we must appreciate.

II. LAYING THE PROBLEM

A. Importance of the problem

In all instruments, equipment and machinery that run on its electric power, we know about them or the environment in which they work, and the induced magnetic field arises as a separate. [4] [5].
Wisp currents are electric currents arising from induced magnetic fields that arise in the instruments, machinery and equipment was localized by changing the magnetic field.
Wisp stream has been an important element of the work and study phenomena to electrical engineers and is distinguished as a separate entity of the electromagnetic field. Discovering wisp currents, the first studies and achievements in the field of planetary currents belonging Jean Bernard Léon Foucault [1] [5] - French physicists.
Currently, the problems caused by wisp currents in the work of the machinery and the impact on environmental conservation has become today, the attitude and evaluation wisp currents, theoretically or practically, cannot be insignificant and without knowing whether the various specialists and so in addition to electrical engineers.
In a certain area of life where we implement electricity, but also in other areas where it can be generated wisp currents can cause significant damage and the consequences so these currents should be evaluated and should be avoided or reduced. In fact, wisp currents are one of the main problems encountered in electrical equipment, affecting work and their normal operation so far attention has focused in this direction skipping consequences and their impact on other areas. [3]
Referring to the studies conducted so far, our work is aimed and aims to assess the problem of environmental pollution wisp currents in port environments, through a mathematical model based on interactive method of Newton for solving nonlinear functions for system functions with many variables, we thought that the problem is studied and untreated in non-homogeneous environments in which magnetic permeability μ environment is not constant. [4]
Through mathematical model that we have chosen to build, in this paper we aimed at factors that determine the level of pollution wisp currents caused in the premises of harbors in our country, from electromagnetic fields generated by the installed electric power and that induced in these port facilities. [5]
Mathematical modelling of factors that determine the value of focusing on electric currents (planetary + vagabonds) in this paper we have started by using Newton's method where we made the determination of electrical parameters disaggregated in polar coordinates to solve the problem of the distribution of flows power and voltage in marine environments as determinants wisp currents.
The problem of the distribution of powers and tensions we have determined by the nonlinear equations system, where for whose solution we used iterative computational mathematical methods. Besides control of the electric power machinery and equipment installed in ports, should be evaluated as an important problem also attributes the selection of materials.
The method of mathematical modelling, using dinators, enables simple and easy solutions, high quickly and accurately estimates the distribution of powers and tensions, through the system of nonlinear equations, whose solution requires the use of iterative computational mathematical methods.
One of the first methods in this area, it is Gaus-Zeidelit. After the 1960 enlargement, strengthening and increasing the request was passed on to other methods the most advanced in terms of convergence and speed of settlement.
The most powerful modern methods in terms of convergence and speed of settlement is that most programs Newton. Today distribution of power flows, voltage levels in machinery, joints and in different environments algorithm uses Newton's method. [2] [3]. An easy way to comply with the conference paper formatting requirements is to use this document as a template and simply type your text into it.

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B. Newton's method for solving nonlinear functions for the system functions with many variables. [6]

Newton's method is iterative and serves for solving nonlinear functions for the system functions with many variables. [4]. [6]. Let it be granted non-linear system:

$$f(x) = \begin{bmatrix} f_1(X) \\ f_2(X) \\ f_3(X) \\ \ldots \\ \ldots \\ \ldots \\ \ldots \\ f_{n-1}(X) \\ f_n(X) \end{bmatrix} = \begin{bmatrix} f_1(X_1, X_2, X_3, \ldots X_n) \\ f_2(X_1, X_2, X_3, \ldots X_n) \\ f_3(X_1, X_2, X_3, \ldots X_n) \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ f_{n-1}(X_1, X_2, X_3, \ldots X_n) \\ f_n(X_1, X_2, X_3, \ldots X_n) \end{bmatrix} \qquad (2.1)$$

Solving this system through iterative method to find the roots for iteration t + 1 according to the Newton method, is given by the equation:

$$x^{t+1} = x^t - \mathrm{J}^{-1}\mathrm{f}(\mathrm{x}^t) \qquad (2.2)$$

Where in this equation we have:

x^t - are popular roots of the system equations in iteration t;

f(x^t)– It is the matrix of nonlinear equations system (2.1) at the point x^t;

J – It is Jakobian's matrix, the matrix partial derivatives of the function f_i (për i = 1,2,3,…,n).

In general terms the resolution of the system of equations with many variables can be determined and in the form the bottom [3]:

$$\begin{bmatrix} \frac{\delta f_1 (X_1^t \ldots X_n^t)}{\delta X_1^t}, \ldots\ldots \frac{\delta f_1 (X_1^t \ldots X_n^t)}{\delta X_n^t} \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ \frac{\delta f_n (X_1^t \ldots X_n^t)}{\delta X_1^t}, \ldots\ldots \frac{\delta f_n (X_1^t \ldots X_n^t)}{\delta X_n^t} \end{bmatrix} * \begin{bmatrix} X_1^{t+1} - X_1^t \\ \ldots\ldots\ldots\ldots \\ \ldots\ldots\ldots\ldots \\ \ldots\ldots\ldots\ldots \\ \ldots\ldots\ldots\ldots \\ X_n^{t+1} - X_n^t \end{bmatrix} = \begin{bmatrix} f_1(X_1^t \cdots X_n^t) \\ \ldots\ldots\ldots\ldots\ldots \\ \ldots\ldots\ldots\ldots\ldots \\ \ldots\ldots\ldots\ldots\ldots \\ \ldots\ldots\ldots\ldots\ldots \\ f_n(X_1^t \cdots X_n^t) \end{bmatrix} \qquad (2.3)$$

III. CHARACTERISTICS AND CAUSES OF USING NEWTON'S METHOD FOR DETERMINING THE ELECTROMAGNETIC PARAMETERS [1],[3],[6].

A.Determination of the phase currents in the industrial aggregate

According to Kirkof law, phase currents in a random nodes K (either source or user) defined by the relation:

$$I_k^0 = \sum_{m \in k} \acute{Y}_{km} * (U_k^0 - U_m^0) \qquad (3.1)$$

Where: $\acute{Y}_{km}$ - conductivity is the branch between the node K and m ;

$\mathring{U}_k = U_k \cdot e^{j\theta k}$ dhe $\mathring{U}_m = U_m \cdot e^{j\theta m}$ – tensions are phased in K nodes and m;

mϵ k - symbol indicating that they are obtained nodes "m" associated with the respective side branches to the node "K";

km = 1,2,3,… N – the nodes name are;

N – is the total number of system nodes including reference nodes.

Value of I, Ů, Y with the mark are complex, and are not a sign of their modules.

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B.*Determinig of complex power*

Complex power calculated at a random nodes K, the iteration t, express the relation:

$$F_k^t + j.G_k^t = \mathring{U}_k^t \cdot \sum_{m \in k} \acute{Y}_{km}^* \,(U_k^t - U_m^t)^* \qquad (3.2)$$

F_k^t – active power is calculated to node iteration K T;
G_k^t – reactive power is calculated to node iteration K t;
$*$- the sign that indicates the value of cognitive respective sizes.

C.The parameters of active and reactive power

Active and reactive powers are functions of θ and U tensions modules, i.e.,

$$F_k = f_k\,(\theta, U) G_k = g_k\,(\theta, U)$$

Taking into consideration the partial differential expression (3.2) towards variables θ and U iteration t, going from full differential on finite additions and taking complex difference between the planned power and that calculated, the system in the form of generalized matrix for each node reads:

$$[F_{\theta km}^t] * [\Delta\theta_k^t] + [F_{Ukm}^t] \cdot [\Delta\theta_k^t] = [\Delta P_k^t] \qquad (3.3)$$

$$[G_{\theta km}^t] * [\Delta\theta_k^t] + [G_{Ukm}^t] \cdot [\Delta U_k^t] = [\Delta Q_k^t]$$

Where we have:

$$\begin{bmatrix} F_{\theta km}^t & F_{Ukm}^t \\ G_{\theta km}^t & G_{Ukm}^t \end{bmatrix} \cdot \begin{bmatrix} \Delta\theta_k^t \\ \Delta P_k^t \end{bmatrix} = \begin{bmatrix} \Delta U_k^t \\ \Delta Q_k^t \end{bmatrix} \qquad (3.4)$$

From where we emphasive: ΔP_k^t, ΔQ_k^t, $\Delta\theta_k^t, \Delta U_k^t$, they represent the backbones matrix, while $F_{\theta km}^t$, F_{Ukm}^t, $G_{\theta km}^t$, G_{Ukm}^t, represent square matrices formed by a partial derivatives.

D.Systems of equations in matrix form [6]

The system of equations (3.4) in matrix form unbuttoned, excluding the reference node labeled with the number 1 and given names and expositions above, takes the form of basic Newtonian relation (2.3) as follows:

$$\begin{bmatrix} \frac{\delta F_{F\theta 2}^t}{\delta\theta_2}, \frac{\delta Fu_2^t}{\delta U_2}, \dots\dots \frac{\delta Fu_2^t}{\delta\theta_N}, \frac{\delta Fu_2^t}{\delta U_N} \\ \frac{\delta G\theta_2^t}{\delta\theta_2}, \frac{\delta G_{u2}^t}{\delta U_2}, \dots\dots \frac{\delta G_{\theta 2}^t}{\delta\theta_N}, \frac{\delta G_{u2}^t}{\delta U_N} \\ \dots\dots\dots\dots\dots\dots\dots\dots \\ \dots\dots\dots\dots\dots\dots\dots\dots \\ \dots\dots\dots\dots\dots\dots\dots\dots \\ \frac{\delta F_{\theta N}^t}{\delta\theta_2}, \frac{\delta F_{UN}^t}{\delta U_2} \dots\dots \frac{\delta F_{\theta N}^t}{\delta\theta_N}, \frac{\delta F_{UN}^t}{\delta U_N} \\ \frac{\delta F_{\theta N}^t}{\delta\theta_2}, \frac{\delta G_{UN}^t}{\delta U_2}, \dots \frac{\delta G_{\theta N}^t}{\delta\theta_N}, \frac{\delta G_{UN}^t}{\delta U_N} \end{bmatrix} * \begin{bmatrix} \Delta\boldsymbol{\delta}_2 \\ \\ \Delta\boldsymbol{U}_2 \\ \dots \\ \dots \\ \dots \\ \Delta\boldsymbol{\delta}_N \\ \\ \Delta\boldsymbol{U}_N \end{bmatrix} = \begin{bmatrix} \Delta\boldsymbol{P}_2 \\ \\ \Delta\boldsymbol{Q}_2 \\ \dots \\ \dots \\ \dots \\ \Delta\boldsymbol{P}_N \\ \\ \Delta\boldsymbol{Q}_N \end{bmatrix} \qquad (3.5)$$

Where we have: $\Delta\theta^t = \theta^{t+1} = \theta^{t+1} - \theta^t$; $\Delta U^t = U^{t+1} - U^t$; Indexs t + 1 and t shows the order number of iterative cycle. The partial derivatives.

$$\frac{\delta F}{\delta\theta}, \frac{\delta F}{\delta U} \; dhe \; \frac{\delta G}{\delta\theta}, \frac{\delta G}{\delta U}$$

who are in the matrix of expression (3.5), calculated as follows:
Given the layout of the Z and Y km vectors in rectangular coordinates in the complex field as shown in Figure 1, the size of branches conductivity between nodes and K m expressed in exponential form is:

$$\acute{Y}_{km} = \acute{Y}_{km}\, e^{-j\,\alpha_{km}}$$

While conjugated:

$$Y^{*}_{km} = \acute{Y}_{km}\, e^{j\,\alpha_{km}}$$

On the other side, since $\alpha_{km} = (90° - \delta_{km})$ we have:

$$\acute{Y}^{*}_{km} = Y_{km}\, e^{j\,(90° - \delta_{km})}$$

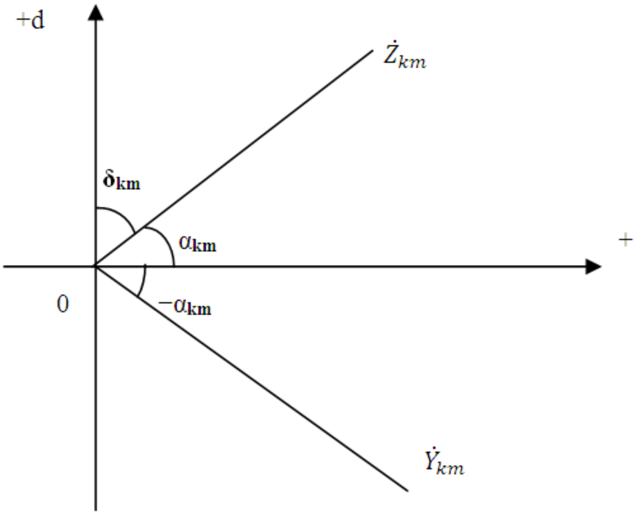

Fig. 1 Showing of the tension vector and conductivity in complex trigonometric form

Module value $Y_{km}$and supplementary anlge δ_{km} determines from parameters of the relevant branch of the electrical network according to the reports:

$$Ykm = \frac{1}{\sqrt{R^2_{km} + X^2_{km}}}\ \delta km = arctg\frac{R_{km}}{X_{km}} \qquad (3.6)$$

where : R_{km} – it is the active resistance of the branch between the node K and m;
X_{km}– reactive-inductive resistance is the branch between nodes K and m.
Complex power calculation for a random network node k is calculated according to the known relation (3.2):

$$Fk + jGk = \mathring{U}k \cdot \sum_{m \in k} \acute{Y}^{*}_{km}\ (\mathring{U}k - \mathring{U}m)*$$

By setting the tension vectors and conductivity in complex trigonometric form, take expressions as follows:

$$Fk + jGk = U_k\ \sum_{m \in k} Y_{km}\, e^{j\,(90° - \delta_{km})} \cdot (U_k \cdot e^{-j\theta k} - U_m \cdot e^{-j\theta m})$$

$$= U_k\ \sum_{m \in k} Y_{km}\, e^{j\,(90° - \delta_{km})} \cdot U_k \cdot e^{j\theta k} \cdot \sum_{m \in k} Y_{km}\, e^{j\,(90° - \delta_{km})} \cdot U_m \cdot e^{-j\theta m}$$

$$= U^2_K\ \sum_{m \in k} Y_{km}\, e^{j\,(90° - \delta_{km})} - \sum_{m \in k} U_k \cdot U_m \cdot Y_{km} \cdot e^{j\,[90° + (\theta - \theta - \delta_{km})]} \quad (3.7)$$

After taking the appropriate actions and [1]:

$$Y_{Ak} = \sum_{m\epsilon k} Y_{km} \cdot \sin\delta_{km} \qquad Y_{Rk} = \sum_{m\epsilon k} Y_{km} \cdot \cos\delta_{km}$$

We will have:

$$Fk + jGk = [\,U^2_k \cdot Y_{Ak} + \sum_{m\epsilon k} U_k \cdot U_m \cdot Y_{km} \cdot \sin(\theta_k - \theta_m - \delta_{km})]$$

$$+ j[U^2_k \cdot Y_{Rk} - \sum_{m\epsilon k} U_k \cdot U_m \cdot Y_{km} \cdot \cos(\theta_k - \theta_m - \delta_{km})] \quad (3.8)$$

From the final equation (3.8), sharing active and reactive component, we will have:

$$Fk = U^2_k \cdot Y_{Ak} + \sum_{m\epsilon k} U_k \cdot U_m \cdot Y_{km} \cdot \sin(\theta_k - \theta_m - \delta_{km}) \quad (3.9)$$

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$$Gk = U_k^2 \cdot Y_{Rk} - \sum_{m\epsilon k} U_k \cdot U_m \cdot Y_{km} \cdot \cos(\theta_k - \theta_m - \delta_{km}) \quad (3.10)$$

Partial derivative of the expression (3.9) in corner θ_k for m = k is:

$$F_{\theta_{kk}} = \frac{\partial F_k}{\partial \theta_k} = \sum_{m\epsilon k} U_k \cdot U_m \cdot Y_{km} \cdot \cos(\theta_k - \theta_m - \delta_{km}) \quad (3.11)$$

By the same analysis and the same reasoning, according to the angle θ_k for $m \neq k$ we have:

$$F_{\theta_{km}} = \frac{\partial F_k}{\partial \theta_m} = - U_k \cdot U_m \cdot Y_{km} \cdot \cos(\theta_k - \theta_m - \delta_{km}) \quad (3.12)$$

While the partial derivative of expression (3.9) under pressure U_k for m = k, is:

$$FU_{kk} = \frac{\partial F_k}{\partial \theta_m} = 2U_k\, Y_{Ak} + \sum_{m\epsilon k} U_m \cdot Y_{km} \cdot \sin(\theta_k - \theta_m - \delta_{km})] \quad (3.13)$$

But under pressure U_m for $m \neq k$, we got:

$$FU_{km} = \frac{\partial F_k}{\partial U_m} = U_k \cdot Y_{km} \sin(\theta_k - \theta_m - \delta_{km}) \quad (3.14)$$

Partial derivative of the expression (3.10) in corner θ_k for $m \equiv k$, is:

$$G_{\theta_{kk}} = \frac{\partial G}{\partial \theta_k} = \sum_{m\epsilon k} U_k \cdot U_m \cdot Y_{km} \cdot \sin(\theta_k - \theta_m - \delta_{km}) \quad (3.15)$$

But according to the angle value θ_m, for $m \neq k$, we will have:

$$G_{\theta_{km}} = \frac{\partial G_k}{\partial \theta_m} = - U_k \cdot U_m \cdot Y_{km} \cdot \sin(\theta_k - \theta_m - \delta_{km}) \quad (3.16)$$

While the partial derivative of expression (3:10) by voltage U_k for m = k is:

$$GU_{kk} = \frac{\partial G_k}{\partial \theta_m} = 2U_k\, Y_{Rk} - \sum U_k \cdot U_m \cdot \cos(\theta_k - \theta_m - \delta_{km}) \quad (3.17)$$

But under pressure U_m for $m \neq k$ we got:

$$GU_{km} = \frac{\partial G_k}{\partial \theta_m} = - U_k \cdot Y_{km} \cdot \cos(\theta_k - \theta_m - \delta_{km}) \quad (3.18)$$

By substituting the expression (2.5) for the partial derivatives pressure and power in specific nodes obtained matrix take this form:

$$\begin{bmatrix} F_{\theta 22}, F_{U22}, \ldots\ldots . F_{\theta 2N}, F_{U2N} \\ G_{\theta 22}, G_{U22}, \ldots\ldots G_{\theta 2N}, G_{U2N} \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ F_{\theta N2}, F_{UN2} \ldots\ldots F_{\theta NN}, F_{UNN} \\ G_{\theta N2}, G_{UN2}, \ldots . G_{\theta NN}, G_{UNN} \end{bmatrix} * \begin{bmatrix} \Delta\delta_2 \\ \Delta U_2 \\ \ldots . \\ \ldots . \\ \ldots . \\ \Delta\delta_N \\ \Delta U_N \end{bmatrix} = \begin{bmatrix} \Delta P_2 \\ \Delta Q_2 \\ \ldots . \\ \ldots . \\ \ldots . \\ \Delta P_N \\ \Delta Q_N \end{bmatrix} \quad (3.19)$$

The number of system equations for N node network, not counting the reference node and labelled with "m" number of nodes with the module fixed voltage (node (P, U) is 2N - m, for nodes (P, U) equation written only ΔP and not ΔQ.
This matrix presents the mathematical model of Newton's method for solving the problem of the distribution of power flows and voltage factors as the basis for determining the level of pollution.

IV. CONCLUSION

Based on the mathematical model according to Newton's method for determining the distribution of power flows and tensions in specific nodes of port facilities, ensure receipt in quick, defining basic parameters wisp currents in these environments. [1]. [6].
Uses of Newton's method realize the determination of electrical parameters disaggregated in polar coordinates to solve the problem of the distribution of power flows and voltage in marine environments.

Method Newton's iterative serving for solving nonlinear functions even for the system with many variables, and contemporary methods in terms of convergence and speed of settlement, which today is widely used in algorithm in most of the distribution of flow programs power, voltage levels in machinery, joints, and in different environments.
The results obtained through mathematical model based on Newton's method from our side would be indicative of the projections of eclectic structures in port areas, but will also be compared with measurements lunch in the existing structures.
We recommend that the work done so far and what the future is a scientific basis to assess the designers of the port facilities or structures, machinery and electrical equipment intended reduction to prevention of pollution from planetary currents in port environments.

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