OVERVIEW

(Dissertation for Doctoral Degree)

Mathematical Study and Evaluation of Contaminant Factors in Port Facilities of the Republic of Albania.

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ABSTRACT

The dissertation presents a theoretical and general description of phenomena arising from electromagnetic fields in natural, industrial and social environments. Through contemporary measurement techniques in two calendar years, the characteristics of the electromagnetic fields present in the port facilities of the Republic of Albania are presented the real state of the electromagnetic fields and the level of pollution from the streams. Based on the results obtained and their interpretation, we have initiated a mathematical model for determining the value of the pollution caused by electromagnetic fields. This mathematical model, referring to meteorological conditions for the study period, evaluates meteorological factors, installed power, and other factors. Determining and testing the factors that determine the characteristics of the electromagnetic fields and the value of the winding currents (resistance, humidity, temperatures, pressure, and others), aiming at monitoring, the

impact of currents on the environment, the normal work of machinery and management teams. This dissertation works on the seaports of the Republic of Albania, part of the transport infrastructure in general and the maritime sector, in particular, supports the Albanian vision and policy for organizing and restructuring the portal infrastructure in accordance with the norms and requirements of the time standards .

Key words: pollution, electromagnetic field, meteorological factors, installed power, mathematical model.

1. INTRODUCTIONI

Earth, water and air have their own electromagnetic field, so humanity has always been surrounded by the electromagnetic field and in particular the currents that induce theseareasin these environments . But with industrialization, theuse of electromagnetic fields has spread widely.

Machinery, equipment, manufacturers of electromagnetic fields as well as television, radio, mobile, telephony, electrical equipment etc. have

grown the presence of these electromagnetic waves, environmental pollution from these waves and their negative consequences. Surface currents are electrical currents that derive from electric circuits or induced by electromagnetic fields that are created, or any other type of currents that are born on earth, water and air from external sources.

Usually, these currents when they are in low value and operate for short intervals do not cause major damage, but when they operate for long intervals and have high current frequencies as sources, they pose a serious risk. Electric winding currents can be either continuous or alternating current that exists for partial time intervals or at continuous intervals.

Surface flow sources in protracted environments are: electromagnetic fields of machinery and equipment installed, corrosion protection installations, galvanic coating systems and installations, electrowelding systems and equipment, induced currents of piping systems lying in port facilities, Induction lines of electrical line cables, railway lines, pipelines, jumper bearings, in or near port facilities, and any breakdowns or defects that may arise in port energy systems. Or all other sources of electricity currents from other electricity

consumers near or on the outskirts ofthe port facilities. (Houses, other industrial infrastructure) .

The level of electromagnetic fields and ignition currents depends on: the machinery and equipment installed and their power, by atmospheric factors (temperature, atmospheric pressure, wave, humidity), salinity content, presence of electrical defects, magnetic and electrical characteristics of environment (materials).

Constant electric waves on the ground, water and air in portal environments cause damage to the normal operation of machinery and causes damages to human health injuries, biodiversity damages (flora and fauna), As well as affect the work of machinery and electrical equipment installed at the gateway.

The high and significant values of their currents or their densities cause not only corrosion as the highest form of damages in the area of maritime transport that are damage to marine environments and damage to infrastructure, but also cause damage to fauna and flora, people and other damage to be assessed. Electric eddy current is the form of pollution that causes the greatest damages from corrosion.

Thus, according to Xhon, corrosion damage caused by carbon steel contained in NaCl solutions

with a concentration of 0.1 N, enclosed by 60 Hz fluorescence fluorescents and 300 density (A/m^2) are very high, while the intensity of bi damage when they are crippled, due to the hydrogen liberating reaction. Also, the risk of corrosion damage and the rate of corrosion of the currents, increases in cases where they are continuous, the value increase increases to 1%.

Damage to corrosion of continuous currents is high especially in aluminum materials and its bonds, namely when their density is 15 (A/m^2), the rate of damage reaches 5% when the density increases to 100 (A/m^2) the injury rate goes to 31%. Despite the impact to the electromagnetic fields on the machinery and equipment and the pollution caused by the currents in ecosystems (fauna and flora), they also have negative consequences for human society.

There is a group of people who repor health problems from electromagnetic fields, headache, dizziness, memory problems, heart rhythm disorders and skin irritation. These are considered sensitive to these domains.

The study data of Carlsson et al. show that 1.9% of people have problems with monitors (not LCDs) and fluorescent lights (these emit electromagnetic waves besides light) 2.4% report inconvenience from

electrical fields. In 1991, William J. Rea concluded that "there is strong evidence that sensitivity to electromagnetic fields exists".

Part of the "allergic" people to electromagnetic fields have serious health problems, they receive medical reports, or disability retire for that reason. Sensitivity to electromagnetic fields is especially popular in Sweden. It is thought that electromagnetic fields increase the risk of leukemia.

2. OBJECT OF STUDY

The object of our study is the land, water and air spaces of the Port of Durrës, the Naval Port of Vlora, the Port of Saranda and the Port of Shengjin, part of the maritime transport infrastructure in our country. These facilities located in the shores of Albania lying between the Adriatic Sea and the Ionian Sea are important not only as part of the transport structures, but also as important objects for tourism.

The study is the object of real direct measurements of the characteristics of the electromagnetic fields created on the seabirds of our country's seaplane, focusing on the pots that

have the largest installed electric power, 50 m and 100 m from them, and in separating environments between cities (residential areas) and port facilities. Our temperature monitoring, atmospheric pressure, wave height, absolute humidity in these study points has also been done on our part.

The Maritime Port of Durrës is located in the northern part of the sea bay of Durres along the coastline with an area of 1400 (m) with a surface area of 670000 (m2), an area of 650000 (m2), with an entry channel of 6755 (ml), width 120 m, depth 9.5 (m), limited to light bulbs from its beginning to the waves, while the depth on the port territory is 7.3 (m) to 11.5 (m).

The Naval Port of Durres is the largest port in Albania that offers all port services. Its port facility consists of 12 marshes with a total length of 2275 (ml) and is able to process about 78% of Albania's international maritime traffic, has a processing capacity of 5,000,000 tonnes per year.

Vlora Sea Port is the second port in Albania of importance, located about 90 km south of the Port of Durres and is defined as the second entrance of Corridor VIII. In this port, the processing of ferry boats with passengers and cargo ships is carried out, covering about 10% of the export-import

goods. The port is in the process of developing its infrastructure and superstructure, which include the construction of the piers for ferries and ferry crossings.

The Naval Port of Vlora is built in the Vlora bay and has a total area of 5,300 (m²) with an aquarium of 5,000 (m²). Depth min. of the port 4.6 (m) and the maximum depth. and port 11 (m). The maximum processing capacity of the goods, loading and unloading is 5400 (tons / 24hrs).

It is an open harbor with 2 main bridge where merchant ships and ferries are processed: Bridge "0" with dimensions 100 X 18 m, depth 3-11 m; Main bridge with dimensions 180 X (10-15) m and depth 2-7 m, processing power 300 - 600 000 tons / year. Processing time for ferries averages 4 to 5 hours, while freight vessels 2-3 days.

The Naval Port of Saranda is the only port in southern Albania and serves the southern cities: Saranda, Delvina, Gjirokastra, Përmet, Tepelenë. The port of the city of Saranda, where the main activities are carried out, has an area of 18 thousand (m²). The port of Saranda is a secondary port located about 160 km south of the Port of Durres, where ships and goods are processed.

As a port within the city with mainly tourist

orientation, for processing of passengers, while processing of goods will take place in the bay of Limion (about 3 km from the port of the city). The processing vessel of the goods has a length of 75 (ml) of diving; 6 (m) depth as well as 2000 (m2) processing squares, in which is installed an electrodync with 5 hooks (tons). Ferry ferry with processing areas 15000 (m2), with contemporary parameters of length 180 (ml), diving up to 9 (m) depth.

The Naval Port of Shëngjin, located in the northern part of the Republic of Albania, is the only port in this area. Within the port space there are closed storage warehouses with a surface area of 2,000 (m2) and 10,000 (m2) space for storing goods.The terminal of the freight terminal is 2,440 (m2), while the newly constructed passenger with modern parameters is 250 (m2). 600 meters length for processing commercial vehicles, and a length of 260 (m) for fishing gear.

The port of Shengjin has a total area of 3.750 (m2) and the surface of the water basin is 3.500 (m2), with an entry channel of 300 m long and 80 m wide, the total depth reaches 7 (m).

The current capacity of the port for the processing of ships is 1,500-2,000 (tonne / day)

(concretely the amount of 30,000 tons of processed cargo per year), vessels of up to 120 (m) can easily be processed.

3.METHOD OF STUDY

The study is made in 2015 and 2016, according to seasonal quarters due to the characterization of meteorological characteristics.The methodology used is evidencing, statistical and graphical processing of meteorological and electo-magnetic fields in the study points for the two-year period, by pointing out the role of meteorology characteristics at the level of electromagnetic pollution.

So, the results obtained have been processed to give a complete overview of electromagnetic pollution in these environments. We conducted our study for a two-year period 2015 and 2016, divided into four time horizons in each quarter to clearly see the role of environmental and metrology characteristics.

4. MEASURING INSTRUMENTS

4.1.Electro-smog measuring instrument TES-92

For the determination of the characteristic parameters of the electromagnetic field and the electric currents in the marine port facilities of Durres we used the electro-smog instrument TES-92.

The electro-smog measuring instrument TES-92 is with three-dimensional spherical 3.5-degree projection and serves to indicate the average value in three directions. It is a frame that shaves and gives 99 values of the front measurements.

For the values that we seek to receive this device requires to preset the boundary values which it ascertains when it is notified through the LCD alarm system.

Figure 2 View of electro-smog measuring instrument TES-92.

The electro-smog measuring instrument TES-92 is field intensity meter through electromagnetic radiation measurement. It is also used to measure wireless LAN, GSM or microwave radiation determination. With a frequency up to 3.5 GHz, it is possible to use the device.

Measuring with the three-dimensional probe saves the calculation of individual axes. Small electro-smog meter with appropriate special properties is used in every area and industry, as well as in simple, fast and accurate labs.

The characteristics of the electro-smog TES-92 measuring instrument are: the frequency range that defines 50 MHz to 3.5 GHz, has a Field Electrical Intensity Sensor (E), for three dimensional isotropic measurements, with values ranging from 38 mV / m to 11 V / m, the measurement of the measurements is automatic.

Measurement units are displayed on its screen in: mV / m, V / m, μgA / m, mA / m, μgW / m², mW / m². Resolution: 0.1 mV / m; 0.1 μg A / m; 0.01 μgW / m², while absolute error in measurement (1V / m and 50MHz) ± 1.0 Db and accuracy (depending on frequency) ± 1.0 dB (50 MHz ... 1.9 GHz) ± 2.4 dB (1.9 GHz ... 35 GHz).

While other parameters can be mentioned: Isotropic Deviation of ± 1.0 dB (in Frequency> 50 MHz), maximum detection area 4.2 W / m² (40 V / m), temperature deviation of ± 1.5 dB and other. The average value obtained is with up to 4-digit LCD resolution, can be repeated for every measured value every 400 ms

The device has a voice alarm signaling system when it exceeds the boundary values, has a calibration factor disruption, and measurements of measured values Maximum, average and minimum.

4.2.Thermo-hygrometer and barometer (atmosphere) PCE-THB 40

Metrological Factor Data Meter is the Thermo-Hygrometer and Barometer (Atmosphere) PCE- THB 40 Temperature, relative humidity and atmospheric pressure from an SD memory card. PCE-THB 40

Figure 3 Overview of Instrument Thermo-Hygrometer and Barometer (Atmosphere) PCE-THB40

Thermohygrometer and barometer-atmosphere can measure ambient temperature, relative humidity, and atmospheric pressure while keeping these results to an SD memory card. PCE-THB 40 thermohygrometer and barometer-atmosphere is a compact data recorder with a large memory capacity (up to 16 GB of SD card).

This device is an ideal tool for prolonged use in the industrial (transport) sector, but also for other measurements in the industrial sector (heating and cooling processes, temperature on cars and warehouses, etc.). The actual value will be displayed directly on a large LCD PCE-THB LCD 40 Hygrometer and Barometer-Atmosphere.

Optional software is the possible and graphical analysis of measured values.

The data is stored directly on the SD card, so it is possible to use analysis using the MS Excel program (eg checking whether a value of a column exceeds the allowed limit). PCE-THB 40 thermohygrometer and barometer-atmosphere has an internal clock to provide people the most accurate results. The metering quota can be adjusted.

Thermocouple and Barometer Instruments The PCE-THB 40 serves for measuring relative humidity, temperature and atmospheric pressure, having a real-time recording memory and a memory card (1 to 16GB), data that are stored directly in the Excel format on the SD card, as the HPA, mmHg and inHg pressure gauges have a large LCD display, it has a simple 2-card hard drive and a software for transferring and analyzing data in computer.

Thermo-hygrometer and barometer-atmosphere PCE-THB 40, 1 x 2GB SD memory card, 1 x card reader. Optionally available: software, ISO-certified, adapter.

5. RESULTS OF THE STUDY

The measurements are carried out for each quarter in 2015 and 2016, on the basis of which we have made an average value for two places, at the entrance to the port and the most loaded with work. Measurements and results are also associated with the values of metrology factors in these areas.

The results obtained are respectively given in the tables below.

Table No. 1. Metrological characteristics and electrical resistance marine facilities

Table No. 2. The level of electromagnetic pollution in the facilities of the Naval Port of Durres (water / earth / air). (Measurements are at 50 m large machining distance).

Table No. 3. The level of electromagnetic pollution in the facilities of the Naval Port of Vlores (water / earth / air). (Measurements are at 50 m large machining distance)

Table No. 4 The level of electromagnetic pollution in the facilities of the Naval Port of Sarandes (water / earth / air). (Measurements are at 50 m large machining distance)

Table No. 5. The level of electromagnetic pollution in the facilities of the Naval Port of

Shengjinit (water / earth / air). (Measurements are at 50 m large machining distance)

6. INTERPRETATION AND DISCUSSION

Referring to the obtained and elaborated results, the level of pollution from the eddy current comes clearly from:

1. Electrical power of machinery installed in the port facilities, where for the largest values are marked at Marine Port of Durres.

2. The presence of electrical faults at different points as a result of the deterioration of the meteorological parameters of the September to March seasons, where the Marine Port of Durres and the Marine Port of Saranda are differentiate because of the geographical position.

3. Values of atmospheric factors (temperature, atmospheric pressure, tumults, humidity), salinity content, and others.

4. Magnetic and electrical environmental characteristics (materials).

Thus, the changes in the values of the characteristics of the electromagnetic field are related to the changes in the humidity content of the

air and soil abrasions which depend on the atmospheric pressure, temperature and characteristics of the sea and other waves.

7. LAYING THE PROBLEM

7.1 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.

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 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 eration so far attention has focused in this direction skipping consequences and their impact on other areas.

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.

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.

Mathematical modeling 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 modeling, 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 .

7.2.Newton's method for solving nonlinear functions for the system functions with many variables.

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

$$f(x) = \begin{bmatrix} f_1(X) \\ f_2(X) \\ f_3(X) \\ \dots \\ \dots \\ \dots \\ \dots \\ f_{n-1}(X) \\ f_n(X) \end{bmatrix} = \begin{bmatrix} f_1(X_1, X_2, X_3, \dots\dots\dots X_n) \\ f_2(X_1, X_2, X_3, \dots\dots\dots X_n) \\ f_3(X_1, X_2, X_3, \dots\dots\dots X_n) \\ \dots\dots\dots\dots\dots\dots\dots \\ \dots\dots\dots\dots\dots\dots\dots \\ \dots\dots\dots\dots\dots\dots\dots \\ \dots\dots\dots\dots\dots\dots\dots \\ f_{n-1}(X_1, X_2, X_3, \dots\dots\dots X_n) \\ f_n(X_1, X_2, X_3, \dots\dots\dots X_n) \end{bmatrix} \quad (7.1)$$

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

$$x^{t+1} = x^t - \mathbf{J}^{-1}\mathbf{f}(\mathbf{x^t}) \quad (7.2)$$

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 functionfi (përi = 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]:

$$\begin{bmatrix} \frac{\delta f_1(X_1^t \dots X_n^t)}{\delta X_1^t}, \dots \dots \frac{\delta f_1(X_1^t \dots X_n^t)}{\delta X_n^t} \\ \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \\ \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \\ \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \\ \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \\ \frac{\delta f_n(X_1^t \dots X_n^t)}{\delta X_1^t}, \dots \dots \frac{\delta f_n(X_1^t \dots X_n^t)}{\delta X_n^t} \end{bmatrix} * \begin{bmatrix} X_1^{t+1} - X_1^t \\ \dots\dots\dots\dots \\ \dots\dots\dots\dots \\ \dots\dots\dots\dots \\ X_n^{t+1} - X_n^t \end{bmatrix} = \begin{bmatrix} f_1(X_1^t \cdots X_n^t) \\ \dots\dots\dots\dots\dots \\ \dots\dots\dots\dots\dots \\ \dots\dots\dots\dots\dots \\ \dots\dots\dots\dots\dots \\ f_n(X_1^t \cdots X_n^t) \end{bmatrix} \quad (7.3)$$

7.3. Characteristics and causes of using Newton's method for determining the electromagnetic parameters.

7. 3.1.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:

$$\mathbf{I_k^0} = \sum_{m \in k} \acute{Y}_{km} * (\mathbf{U_k^0} - \mathbf{U_m^0}) \quad (7.4)$$

Where: $\acute{Y}_{km}$ - conductivity is the branch

between the node K and m ;

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

mϵk - 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, $\mathring{U}$, Y with the mark are complex, and are not a sign of their modules.

7. 3.2. Determinig of complex power

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

$$\boldsymbol{F_k^t + j.G_k^t} = \mathring{U}_k^t \cdot \sum_{m\epsilon k} \acute{Y}_{km}^* \, (U_k^t - U_m^t)^* \quad (7.5)$$

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.

7.3.3.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 (7.6) 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:

$$[\boldsymbol{F^t_{\theta km}}] * [\Delta\theta^t_k] + [\boldsymbol{F^t_{Ukm}}] \cdot [\Delta\boldsymbol{\theta^t_k}] = [\Delta\boldsymbol{P^t_k}] \quad (7.6)$$

$$[\boldsymbol{G^t_{\theta km}}] * [\Delta\theta^t_k] + [\boldsymbol{G^t_{Ukm}}] \cdot [\Delta U^t_k] = [\Delta\boldsymbol{Q^t_k}]$$

Where we have:

$$\begin{bmatrix} F^t_{\theta km} & F^t_{Ukm} \\ G^t_{\theta km} & G^t_{Ukm} \end{bmatrix} \cdot \begin{bmatrix} \Delta\theta^t_k \\ \Delta P^t_k \end{bmatrix} = \begin{bmatrix} \Delta\boldsymbol{U^t_k} \\ \Delta\boldsymbol{Q^t_k} \end{bmatrix} \quad (7.7)$$

From where we emphasive:

ΔP_k^t, ΔQ_k^t, $\Delta\theta_k^t$, ΔU_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.

7. 3.4. Systems of equations in matrix form

The system of equations (7.8) 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 (7.4) as follows:

$$\begin{bmatrix} \frac{\delta F_{\theta 02}^t}{\delta \theta_2}, \frac{\delta F u_2^t}{\delta U_2}, \dots\dots\dots \frac{\delta F u_2^t}{\delta \theta_N}, \frac{\delta F u_2^t}{\delta U_N} \\ \frac{\delta G\theta_2^t}{\delta \theta_2}, \frac{\delta G_{u2}^t}{\delta U_2}, \dots\dots\dots \frac{\delta G_{\theta 2}^t}{\delta \theta_N}, \frac{\delta G_{u2}^t}{\delta U_N} \\ \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \\ \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \\ \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \\ \frac{\delta F_{\theta N}^t}{\delta \theta_2}, \frac{\delta F_{UN}^t}{\delta U_2}, \dots\dots\dots \frac{\delta F_{\theta N}^t}{\delta \theta_N}, \frac{\delta F_{UN}^t}{\delta U_N} \\ \frac{\delta F_{\theta N}^t}{\delta \theta_2}, \frac{\delta G_{UN}^t}{\delta U_2}, \dots \frac{\delta G_{\theta N}^t}{\delta \theta_N}, \frac{\delta G_{UN}^t}{\delta U_N} \end{bmatrix} * \begin{bmatrix} \Delta\delta\theta_2^t \\ \Delta U_2^t \\ \dots\dots \\ \dots\dots \\ \dots\dots \\ \Delta\theta_N \\ \Delta U_N \end{bmatrix} = \begin{bmatrix} \Delta P_2^t \\ \Delta Q_2^t \\ \dots\dots \\ \dots\dots \\ \dots\dots \\ \Delta P_N \\ \Delta Q_N \end{bmatrix} \quad (7.8)$$

Where we have: $\Delta\theta^t = \theta$t+1 = θt+1 - θt ; ΔUt = Ut+1 - Ut ; Indexs t + 1 and t show the order number of iterative cycle. The partial derivatives.

$$\frac{\delta F}{\delta \theta}, \frac{\delta F}{\delta U} \quad dhe \quad \frac{\delta G}{\delta \theta}, \frac{\delta G}{\delta U} \quad (7.9)$$

who are in the matrix of expression (7.8), calculated as follows:

By substituting the expression (7.9) for the partial derivatives pressure and power in specific nodes obtained matrix take this form:

$$\begin{bmatrix} \boldsymbol{F_{\theta 22}}, \boldsymbol{F_{U22}}, \dots\dots \boldsymbol{F_{\theta 2N}}, \boldsymbol{F_{U2N}} \\ \boldsymbol{G_{\theta 22}}, \boldsymbol{G_{U22}}, \dots\dots \boldsymbol{G_{\theta 2N}}, \boldsymbol{G_{U2N}} \\ \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \\ \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \\ \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \\ \boldsymbol{F_{\theta N2}}, \boldsymbol{F_{UN2}} \dots\dots \boldsymbol{F_{\theta NN}}, \boldsymbol{F_{UNN}} \\ \boldsymbol{G_{\theta N2}}, \boldsymbol{G_{UN2}}, \dots \boldsymbol{G_{\theta NN}}, \boldsymbol{G_{UNN}} \end{bmatrix} * \begin{bmatrix} \Delta\theta_2 \\ \Delta U_2 \\ \dots \\ \dots \\ \dots \\ \Delta\delta_N \\ \Delta U_N \end{bmatrix} = \begin{bmatrix} \Delta P_2 \\ \Delta Q_2 \\ \dots \\ \dots \\ \dots \\ \Delta P_N \\ \Delta Q_N \end{bmatrix} \quad (7.10)$$

The number of system equations for N node network, not counting the reference node and labeled 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.

8. CONCLUSIONS

The study object, the results obtained from the meteorological factors monitoring, the measurements made on the characteristics of the electromagnetic fields in the port facilities give a clear picture of the eddy current pollution in these environments.

According to this study, the level of pollution from the eddy currents depends not only on the installed electric power and the presence of possible technical defects but also depends on the content of the absolute humidity, temperature and atmospheric pressure in these environments. Factors that depend on the position of the shore, the protection system from the eras and the waves, the weather, etc.

The metrological factors play a decisive role in the environment's impact on its conductivity, the environments directly reflect on the parameters of the magnetic and electron field surrounding these environments.