УДК 528.831.1

THE SOLUTION OF THE PROBLEM WITH ELEKTROMAGNITNOI COMPATIBILITY RADOCHINA MEANS OF MOBILE COMMUNICATION SYSTEMS IN THE STANDARDS FOR 4G AND 5G

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Рішення проблеми з електромагнітної сумісності радіоелектронних засобів систем мобільного зв'язку в стандартах 4G та 5G

В статі розглянуто нові тенденції розвитку телекомунікацій та вимоги до нових стандартів мобільного зв’язку. Запропоновано математична модель оцінки стійкості функціонування систем мобільного зв'язку при електромагнітних взаємодіях РЕЗ, що вводяться в систему дозволяє розглядати точки рівноваги системи при взаємодії різних РЕЗ, що дозволяє аналізувати її при конкретному виборі значень керуючих параметрів, наявності ресурсів.

Present in the communications industry due to the transition process in which interval the transition from "industrial age" in the "information age" almost completed.

The increase of the number of devices connected to the Internet over the past 10 years, is 10-100 times. So Cisco predicts 18-fold increase in mobile traffic from 2012 to 2017. Thus the projected growth of data traffic in mobile networks, and constantly growing number of users.

Based on all the above we can conclude that the transition and implementation of standards for 4G and 5G communication is essential to meet the needs of users.

So the fourth generation usually referred promising technology to transmit data at speeds in excess of 100 Mbit / s - moving and 1 Gbit / s - stationary subscribers.

Telecommunications Standards fifth generation connection is not complete, but by Huawei, introduced wireless networking technology that can achieve data rates above 10 Gb / s.

The uniqueness of the new generation is to be used any range of any access technology that is not a fixed radioparametry as in modern wireless networks. Perhaps the concept of roaming disappear, and thus the associated costs subscriber.

Due to the avalanche increase in the number of subscribers in the mobile network and increase traffic transmitted data is a problem in ensuring electromagnetic compatibility of radio electronic devices provider.

To ensure the electromagnetic compatibility of radio electronic devices mobile in their electromagnetic interactions with the introduction of new devices, the mathematical model for evaluating sustainability of the systems.

$$\Phi_i\left(\Psi_i; C_k; t; \frac{d\Psi_j}{dt}; \frac{d^2\Psi_j}{dt^2}; \dots\right) = 0, \tag{1}$$

Thus the model includes elements of the system, control parameters and system parameters (1). As mobile communication system is a dynamic system of the expression (1) can be described across a gradient (2)

$$\Phi_i = \frac{d\Psi_j}{dt} + \frac{\partial V(\Psi_j, C_k)}{\partial \Psi_i}. \quad (2)$$

Fig. 1 submitted Earl functional interactions described by electronic means system (3)

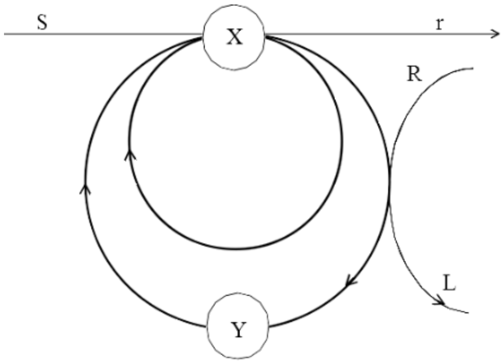

Fig. 1. Count functional interactions SEM

$$\begin{cases} \frac{dX}{dt} = S - (R+1) \cdot X + X^2Y; \\ \frac{dY}{dt} = RX - X^2Y. \end{cases} \quad (3)$$

which included the following functional characteristics of the system evolution:

RX- speed reducing resource through the park RES is introduced into the system;

X^2Y - the resources that came in after failing to resist the system.

The system of equations (3) concluded in the framework bryusselyatornoy model. If align speed (3) to zero, we obtain the equation of equilibrium dynamic systems:

$$\begin{cases} X = S; \\ Y = \frac{R}{S}. \end{cases} \quad (4)$$

In the practical implementation of this model may be deviation values of x and y from the equilibrium state (6). The system thus becomes:

$$\begin{cases} \dot{x} = x(R - i) + y(S^2) + x^2\left(\frac{R}{S}\right) + 2xyS + x^2y; \\ \dot{y} = y(-R) + y(-S^2) - x^2\left(\frac{R}{S}\right) - 2xyS - x^2y. \end{cases} \quad (5)$$

The resulting system should be analyzed from the standpoint of resistance variation parameters. Limited to linear on x and y members get

$$\begin{cases} \dot{x} = a_{11}x + a_{12}y; \\ \dot{y} = a_{21}x + a_{22}y. \end{cases} \quad (6)$$

where.

$$a_{11} = R = i, a_{21} = -R, a_{22} = -S^2$$

After converting the respective (6) takes the form of characteristic equation

$$\lambda^2 = \lambda \cdot (a_{11} + a_{22}) + a_{11}a_{22} - a_{12}a_{21} = 0 \quad (7)$$

where the coefficients which are respectively:

$$a_{11}a_{22} - a_{12}a_{21} = S^2;$$
$$-(a_{11} + a_{22}) = 1 + S^2 - R. \quad (8)$$

Positive and true value of guarantees from the instability caused by zeroing the first factor.

The second factor is zero when. Obviously, if there is a steady focus, while at the - unstable, ie when there is a Hopf bifurcation dynamic that creates the critical limit cycle. Thus, in this case using the parameter R as control leads to a symmetric assembly type disaster or classification Tom to disaster type.

$$R_0 = 1 + S^2R < 1 + S^2R > 1 + S^2R = 1 + S^2\text{A} \pm (2\text{к} + 1)$$

Conclusions. A mathematical model for evaluating sustainability of mobile communication systems with electromagnetic interactions RES entered into the system can be considered the equilibrium point of the system by the interaction of different RECs that can analyze it at the particular choice of values of control parameters, available resources and the related restrictions on quality information transmission. Based on this analysis can predict the development of mobile communication systems, EMC and its timely divert it from disaster. In addition, by analyzing the solutions can not determine the range of possible disturbances that do not cause significant qualitative change in the behavior of the system, ie to determine the range of adaptability.

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