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COMPUTER SYSTEM OF ANALYSIS OF AIRION DISTRIBUTION ON INCLINED PLANE

On the basis of theoretical and practical research results of spreading of concentration of negative ions from artificial sources of airion radiation in industrial and domestic premises the proposed computer system of analysis of airion distribution on an inclined plane.

Keywords - negative airions, airionizer, angle of incline, inclined plane, a computer system, the environment-above mathematical processor Maple.

Introduction

In our time of rapid urbanization most people spend 90% of their time in doors: at home and at work. The people inhaled air with high levels of pollution, with insufficient oxygen. In particular, the dust is a enormous source of infections, the only means of moving bacteria, viruses and dust mites, which bring in doors allergies and diseases. Through this raises the problem of air purification. One of the measures the approximation of the air in such spaces to optimal conditions is its saturation with negative airions [2,3]. The negative air ions have curative and preventive action - contribute to the activation of the immune system, normalize respiratory metabolism and blood pressure, have anti-stress, anti-microbial and anti-viral effect [3].

Airionizers apply for saturate the air of negative ions. Graphically the distribution of the concentration of negative ions from airionizer is determined using special cards. On this cards coated the lines of equal concentration of ions - isolines. It is known that with mine the angle of the plane for which the calculations are being done, changing the coordinates of the points of isoline [4]. For prognosis and visualize the distribution of the concentration of negative ions by changing the position of the considered plane it is necessary to develop a computer system for analyzing this distribution.

Analysis of recent research and publications

In second half of the twentieth century has spread direction of science and technology, which is based on the use of force of electric fields on electroporation share. This direction known as electron-ion technology. The results of numerous are conformity to natural lows of distribution of negative ions on a horizontal plane from one or more airionizers [3]. In our time, has increased the interest in the study of the distribution of the concentration of ions from artificial sources airion radiation. The questions came up modeling and prognosis of the process and the layout of airionizer in specified areas. The scientific work [1,2] light the way for definition the pattern of distribution of negative ions from airionizer. In these studies, a method of geometric modeling of the distribution of negative ions, which allows the detection zone air ion comfort and discomfort in the workplace from one or more ionizers on a horizontal plane. The distribution concentration of ions in the inclined plane is considered in work [4].

The purpose of the article

An algorithm for modeling the distribution of the concentration of negative ions on an inclined plane on the basis of the results studies of the distribution of concentration of negative ions from an artificial source air ionic radiation in the environment of mathematical processor Maple is offered in this article.

The main material

The geometrical model of the distribution of the concentration of ions at one source of radiation on the horizontal plane is a isoline in the shape of circles, as re-the result of crossing with the horizontal plane areas as spatial iso-surfaces [2]. In real terms there are areas, which has gender is under some acute angle to the horizontal plane (Auditorium Theater, lecture hall etc.). Figure 1: Σ_1 - horizontal plane; Σ_1' - inclined plane;

α - the angle of inclination of the plane about which the calculations are being done (inclined plane); N - center airionizer; N_1 - projection of the center of airionizer on the estimated plane; A_i' - point on isoline of concentration of negative ions.
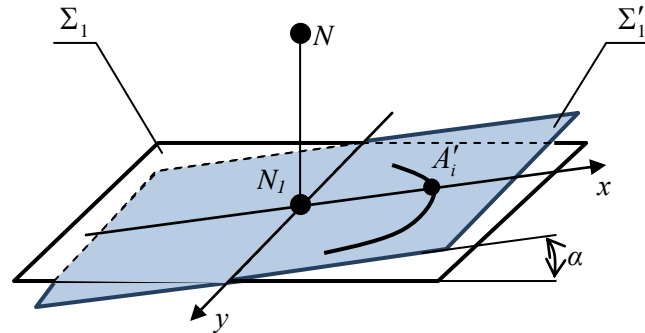

Fig.1. The position of the estimated plane

Given the distribution of the concentration of negative ions on a horizontal plane from source ions [2] and the angle α of an inclined plane, we write the equations for modeling the distribution concentration of negative ions on an inclined plane:

$$n' = \frac{1}{a(x^2 + y^2) + b} 2^{-xtg\alpha}, \qquad (1)$$

де n' - the concentration of negative ions in the estimated point on the inclined plane, ion/cm^3;

   a,b – are coefficients that depend on the strength of the radiation source [2];

   α - an angle is calculated relative to the horizontal plane, ^{0};

   x,y - are coordinates of the center airionizer on an inclined plane, m.

On the basis of the obtained regularities (1) prepare the algorithm for modeling the distribution of the concentration of negative ions on an inclined plane from one airionizer in environment mathematical processor Maple. The algorithm contains the following steps: first, determine the values of the coefficients *a* and *b*; next are the coordinates of the source air ionic radiation relative to the adopted coordinate system; after you define the necessary level of concentration negative the ions and the angle of the estimated plane α; after setting all necessary parameters are set by law airion distribution; further displaying on the screen an image obtained curve is the isoline of concentration of negative ions. For displaying an image of the original isoline of concentration of ions will use the operator plot and implicitplot.

On fig. 2 the program listing (a) and the result of this program (b) as a special case is showed.

```
> a := 0.23e-4;
> b := 0.44e-4;
> r1 := x^2+y^2;
> n := 2000;
> f1 := n = 2^(0*x)/(a*r1+b);
> f2 := n = 2^(-0.34*x)/(a*r1+b);
> with(plots);
> implicitplot({f1, f2}, x = -8 .. 8, y
= -8 .. 8);
```


a)   *б)*
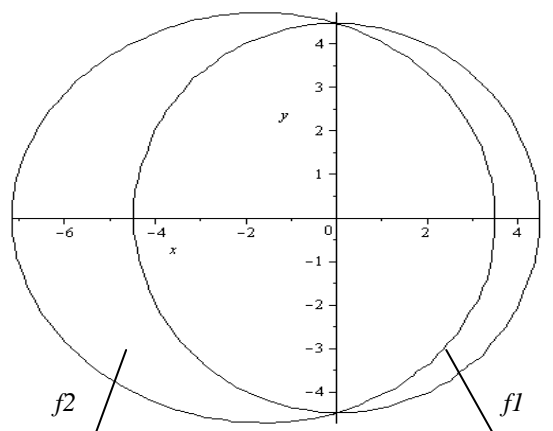
Fig. 2. Computer system of analysis of air ion distribution on inclined plane

Figure 2,b shows two curves: *f1* - curve at $\alpha=0^0$; *f2* - curve at $\alpha=20^0$. Analysis of the obtained isolines shows that when the angle of inclination of the estimated plane is offset from the coordinates of the corresponding points of the given curve.

Figure 3 shows isolines of the concentration of the ions from one source airion radiation on an inclined plane. Each isolines corresponds to a set value of the concentration of negative ions: 2000, 4000, 6000 and 10000 ion/cm^3 at an angle of inclination of the estimated plane $\alpha=5^0$ and $\alpha=10^0$.
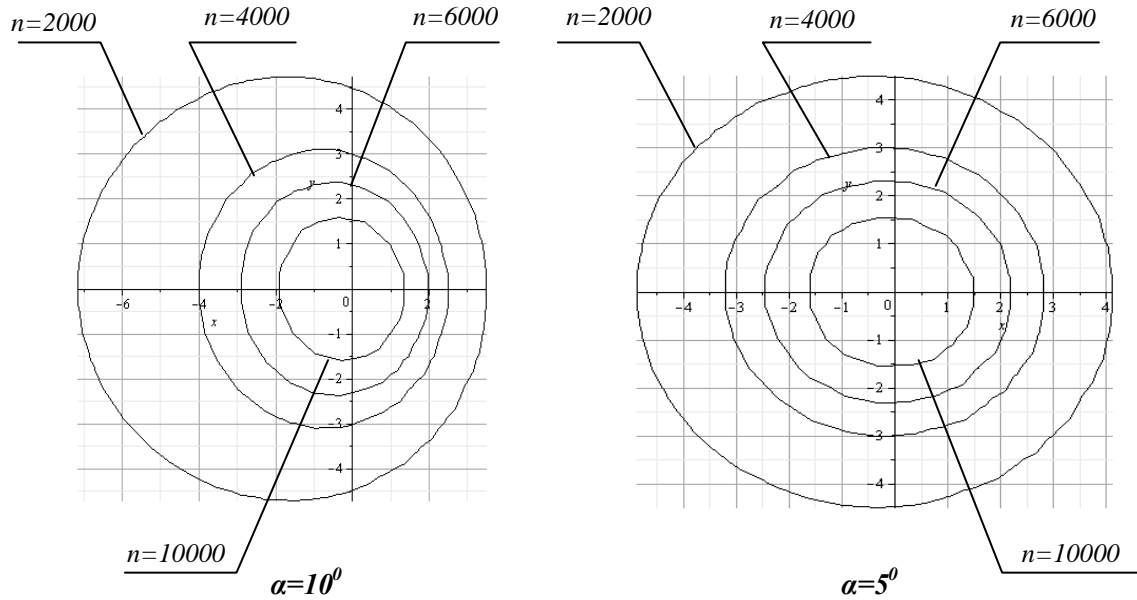

Fig. 3. Isolines of concentration of negative ions on an inclined plane at angles $\alpha=10^0$ and $\alpha=5^0$

The increase of the inclination angle calculated relative to the horizontal plane increases the curvature of the isolines. Under certain parameters, the isoline is broken: fig. 4 ($\alpha=20^0$) - *n=2000* ion/cm^3 and *n=4000* ion/cm^3. The larger the value of a given (normalized) concentration of negative ions, the more likely the existence of isolines of concentration of ions.
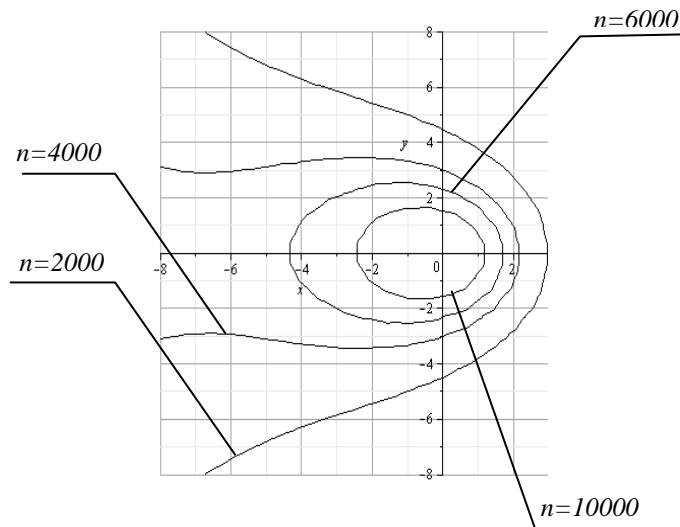

Fig. 4. Isolines of concentration of negative ions on an inclined plane at angles $\alpha=20^0$

The computer system allows you to visualize the distribution process of concentration of negative ions from airionizer in a work space and to analyze the received picture. The results of the analysis can be used by designing the location of the systems of ionization of the air space, which have inclined estimated plane - lecture halls, cinemas and so on, as well as by placing personnel in these premises.

The conclusions

The computer system of analysis of airion distribution on inclined plane uses the medium of mathematical processor Maple and allows you to visualize the distribution process of concentration of negative ions in premises, which have inclined plane. The proposed algorithm for modeling of distribution of the concentration of negative ions in the environment mathematical processor Maple allows you to get a picture of the distribution of ions on the inclined plane at different position (when the angle of inclination to the horizontal plane from 0^0 to 90^0). The obtained results can be used by designing of the location of the system air ionization to ensure standardized indicators of the concentration of negative ions in industrial and domestic premises.

1.Спосіб визначення однакового рівня концентрації аероіонів від двох розсіювальних джерел аероіонного випромінювання [Текст]: пат. 48805 Україна: МПК9 A62L/9/22 , A61N 1/44 / Строкань О.В., Івженко О.В., Чураков А.Я.,; заявник і патентовласник Таврійський державний агротехнологічний університет. - №2009 04661; заяв. 12.05.2009; опубл. 12.04.2010, Бюл. №7. – 4 с. 2.Строкань О.В. Геометричне моделювання процесу розподілення негативних аероіонів у закритому просторі [Текст]: дисс.... канд. техн.наук /О.В. Строкань. - Мелітополь, 1010. – 172 с. 3.Чижевский А.Л. Аэроионы и жизнь. Беседы с Циолковским [Текст] / Чижевский А.Л. - М.: Мысль, 1999. – 716 с.4.Чураков А.Я. Визначення ізоліній концентрації аероіонів на похилій площині [Текст]/ А.Я.Чураков, О.В. Строкань , О.І. Морозова// Прикладна геометрія та інженерна графіка. - Мелітополь, 2011. – Т.50. - С.85-89.