THE METHOD OF CONSTRUCTINGHYPERBOLICGRIDSACCORDING TOTHE DIFFERENCES OFTHE MEASUREDDISTANCES

O. Denisov, M. Petriv

Statement of the problem

The mathematical basis of maps is a set of elements, which is the mathematical relationship between the card and the surface that it is displayed. The mathematical elements of cards include scale cartographic projection and coordinate grid. In general, the notion of coordinate grid represents a flat picture of the totality of the lines of the Earth ellipsoid, depicted on the map of the appropriate lines. The geodesy base of maps is a set of geodetic data that are used to create the map. Elements of the geodetic base map is the anchor points, the coordinates of which are given in the selected to perform surveying coordinate system, the coordinate grid, built in the same coordinate system.

For the design and implementation of marine surveying, there is a need to build on your tablet to the specified area of the marine waters of the coordinate grid. When applying the radiolocation systems and individual objects in the marine environment is defined in the system of hyperbolic coordinates. On this basis, on the tablet except kilometer mouse grid plotted also hyperbolic coordinate grid.

Analysis of recent studies and publications relating to the solution of this problem

Currently in the literature describes three ways of construction of hyperbolic coordinate grids: graphic, for supporting points and the coordinates of the points of hyperboles. The graphical method is used in cases of measurable work low accuracy,and for the rapid determination of the approximate location of a moving object. The second method is used in cases of high accuracy location determination in the marine environment. The third way belongs to the category of ways the highest accuracy of the definitions in the marine environment. The analysis of these ways you can make the following conclusions: the first two ways are enough simple to construct, but is used in cases where the area of the works displayed on the letter cards together with anchor points; the third requires the use of a large number of formulas, and additional graphic drawings.

Summary of basic material

We offers much simpler for all indicators method of construction of hyperbolic grids that can be used in the performance of marine surveying in high accuracy. The essence of this method is the following.

As you know, hyperbolic grid appears to isoclines the two families. Each family of isocline built against two coastal strongholds, which are applicable hyperboles of this family. In practice the use of radio systems in most cases as anchor points choose three items, one of which is taken as the reference for the two families. Such a point is called a central (figure this item 3), the two remaining items – sidewall (this figure is the points 1 and 2). Location of item definitions always coincides with the point of intersection of the two isoclines the position of different families.

The sequence of construction of hyperbolic grids proposed a way to consider the example of a family of 3-1. Initial data for constructing a hyperbolic grid of this family is a flat rectangular coordinates x, y points 1 and 3 and the corner points of the district works (this figure is a point a, b, c, d). The solution of inverse geodetic problem between the anchor points and corner points of works we find the distance r_1, and r_3, and, where is the number of points a, b, c, d with calculated four distances r_1, and find the minimum and maximum value – r_{1min} and r_{1max}. With similar calculations on distances r_3, and get the value of r_{3min} and r_{3max}. Obtained values of the minimum and maximum values recorded to truncateof the variables, multiple l-difference numerical values of neighboring coordinate lines created by hyperbolic grids.

The next step is to calculate the lengths of the sides, which fall in the interval between rounded minimum and maximum values recorded separately for the lines relatively

strong points 1 and 3. Take that distance $r_{1,1}$ is equal to the truncate value r_{1min}. Then the distance $r_{1,2}$ will be equal distance $r_{1,1}$ increased the amount of *l*, and $r_{1,3} = r_{1,2} + l$. Such a calculation is performed to fulfill conditions of the r1, and r1max =, where is the number of lines for this family. To based on these calculations, we obtain a family of lengths of lines relative to a reference point 1. Similar calculations are performed on the lengths of the lines relative to the reference item 3.

As a result, we have two anchor points with the famous flat rectangular coordinates, and two of the lengths of the lines from these points to the points of a given area of survey works. The following data is output when starting a linear notch. Therefore, all subsequent calculation are in applying formulas of linear notch for getting the coordinates of the points that correspond to the position of points of intersection of the circles, the centers are anchor points 1 and 3, and radii of circles, which are the lengths of lines r1, and r3, and the existence of two families of the lengths of the lines are the basis of gradual solving of linear serif using lengths of lines r1, and r3 and in their combinations in each individual tasks as shown in the table.

Inside the table shows the number of points (from 1 to + II), the coordinates of which are determined by solving linear serif with all combinations of lengths of lines r1, and r3, and note that a point located in the Diagonal cells of the table (for example, points 1, 2 + and 3 +2 and + II) represent a point with the same difference lengths of lines r3, and r1, and after solving all the serif the obtained coordinates of these points they inflict on your tablet or on the map area works. By connecting the dots of the same difference lengths of lines gettheisoclines provisions represent the first iteration, with the magnitude, which corresponds bycalculate hyperbolic coordinate (r3, and – r1, I) of isoclines 3-1. Note that for all constructed so isoclines tricks are the pivot points 1 and 3.

A similar calculation and suppressing carry on strong points 2 and 3. Struck by this scheme are two of the isoclines provisions represent hyperbolic grid on a given area of survey works in marine environments.

Conclusions

1. For computing formulas of linear notch can use any math package, for example, in Excel, which is able to build the table of coordinates of points. Construction of hyperbolic grids for district ofsurvey works is proposed to carry out using the API package Surfer. Due to such offer high precision, all the graphic constructions using this package and the observance of scale on both coordinate axes.

2. In this way the accuracy of the hyperbolic grids easily adjustable by decrease or increase of the density of the lines of the grid (size l).

3. The advantages of this method of hyperbolic grids before existing ways lie in the simplicity of his mathematical calculations and graphical constructions.