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By graphic method and using computer programs Determination of the location function of spherical lever mechanisms

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Abstract

The paper discusses the definition of the location function and graphic method for spherical mechanisms. It addresses both the analysis and synthesis tasks involved in decision-making. The proposed approach involves various geometric figures, particularly spheres, to efficiently solve movement tasks on their surfaces. This method provides a visible and less time-consuming way to determine the coordinates of separate points on spherical mechanisms.

keywords: Analysis, synthesis, geometric Figure, sphere, retina, orthogonal coordinates.

Introduction

Geometric character Modern technical tasks solution to the majority in case Analytical methods by means of happens. despite that _ _ this time research results is accepted beforehand Given With accuracy, anyway should to note graphic for methods characteristic whole row Advantages.

practice shows that _ mechanisms and tools construct to the majority cases it is possible Let's go more rationally and Effectively, if We will use it computer equipment. desired each one task when deciding Let's take advantage orthogonal Planned, something If Their use technical in the field Worker any for an engineer is available and no They are married of cadres special to prepare. It should be noted here that, using modern computer programs, it became possible to carry out kinematic and dynamic calculation and construction of mechanisms with acceptable accuracy for engineering practice.

Thus, engineer - technical to the staff and various in the field working Constructors are given indefinite creative abilities tools, mechanisms and of cars research methods during selection.

spherical mechanisms kinematic analysis time more difficult as an operation is considered mechanism location function Determine which _ it is possible to express only high row with equations. hard structure having mechanisms kinematic with the analysis connected tasks solution happens certain sequence With protection, theirs build and structure considering.

Submitted article basic The goal is engineering for practice Acceptable research easy and visible method offer.

Currently, the capabilities of modern computer hardware and programs allow us to solve technical tasks of any complexity based on the development of new mathematical models and to practically use any method of mechanism research with predetermined accuracy.

Main part as It is known, the field on the surface located on the point sphere belonging to lots of circumference It's awesome possible _ A That's why sphere on the surface located N point to build First sphere belonging to any n circumference let's build (Fig. 1a) and then on it N point let's mark

Suppose there is a center O, and two ρA located on the surface of a sphere of radius =1 and Point B. It is necessary to define such a point C located on the same surface that from the mentioned points the pre-given < COA and < COB will be spherically spaced. It is clear that sphere on the surface Such two point They will exist sphere of those segments bases crossing points will be whose vertices A and B is straight, while viewers Accordingly ⌒ AC and ⌒ BC Sections equal (Fig. 1b).

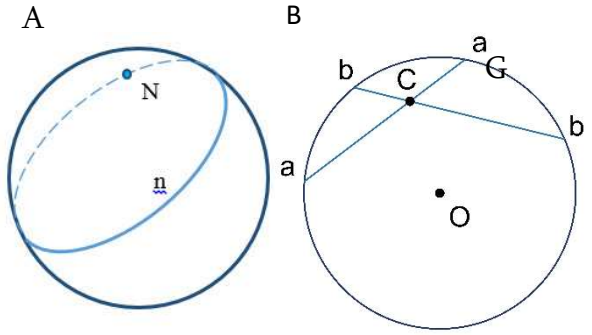


fig. 1

In general, a lever mechanism with one or more degrees of movement is obtained by connecting one or more structural groups to the driving ring or rings. The sequence of conducting kinematic research and joining these groups coincides (identical). Taking them into account, we can obtain one of the well-known structural models of kinematic research of lever mechanisms using standard computer programs. The locations of the outer kinematic pairs will be known for the simplest type of two-rod groups, and the goal of the study is to determine the location of the middle kinematic pair. In this way, the location of any point in the mechanism can be found. This approach to kinematic research is valid for all types and modifications of lever mechanisms. So for example:

Let's conduct a kinematic analysis of the four-ring spherical lever mechanism (Fig. 2) using purely graphic and computer software AutoCAD [1-3].

Also: 1. Kinematic diagram of spherical four-ring lever mechanism f_1

2. Generalized coordinate variation function with time

In the relation $f_1 = f_1(t)$.

3. a_1, a_2, a_3, a_4, curved, curved, sided, vertical

There are central corners (Fig. 2).

Determine the location function of the lever mechanism ABCD $f_3 = f_3(f_1)$ (Fig. 5).

A semi-constructive diagram of the four-ring lever mechanism is given (Fig. 2).

Angles a $_1$, a $_2$, a $_3$, and a $_4$, - dimensions of the rings - function of variation of the rotation angle of the input ring - (generalized coordinate) with time ω= f(t) It is necessary to determine the location plan of the mechanism.

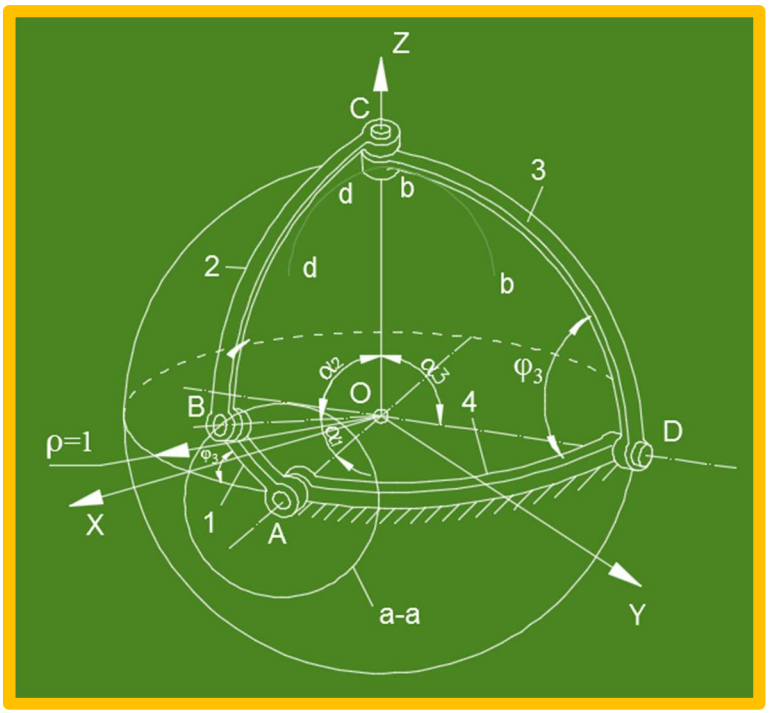


fig. 2

We conduct kinematic research in the following order:

1. Let's do it unit radius having sphere Spread out.

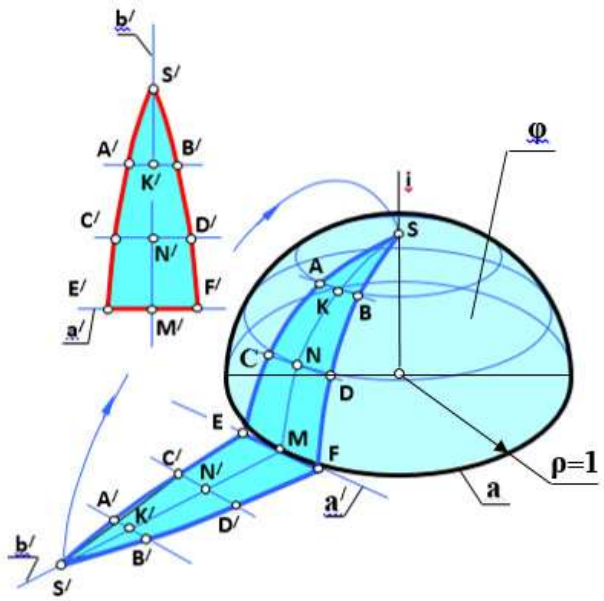


fig. 3

2. Received spread out by means of let's create two Hemispherical surface ω.
3. Let's cover it with the resulting surfaces, up mentioned sphere.

4. Mark two fixed points on the surface of the sphere A and D red.

5. From point A as the center, draw a circle |AB| cord

with equal radius. Let's mark one of the points B on the circle aa.

6. From one of the marked points in our case B ^{2} as

from the center |BC| Draw an arc bb with a radius equal to the chord.

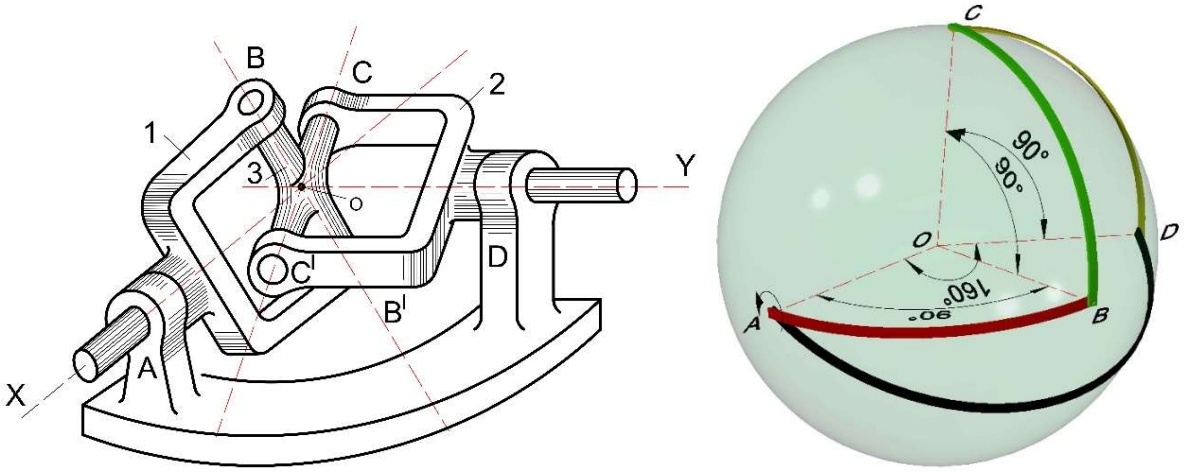
7. Similarly from point D |DC| Let's circle it with a radius equal to the chord

dd arc.

8. The point of intersection of arcs b and d is the point C to be searched for.

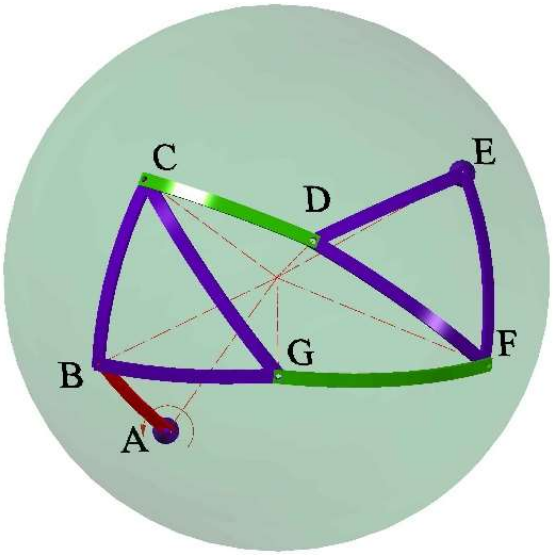
Connect points A, B, C and D with appropriate arcs. As a result, we got a plan of the locations of the mechanism in the second state.

Similarly, it is possible to determine the spatial (spherical) gear points for different locations of the drive ring. The fourth figure shows spherical shape four rings Leverage mechanism private the case hook Universal joint so Cardan Mechanism. in which <AOB=<BOC=<COD da 165 ≤<AOD ≤180 ^{0} (nax. 4). In this case, the use of the graphic method is appropriate due to the simplicity of the mechanism, but for a more complex mechanism, determining the location of any point of the mechanism is quite a laborious task.



nax. 4

The fifth drawing shows a spatial (spherical) six-ring lever mechanism of the fourth class, for which the above-mentioned method can certainly be used, but it is quite time-consuming. Therefore, let's use the computer program AutoCAD, this method simplifies graphic work, and the computer program Inventor allows us not only to build any point of the mechanism, but also to test the prototype (model) of this mechanism.



nax. 5

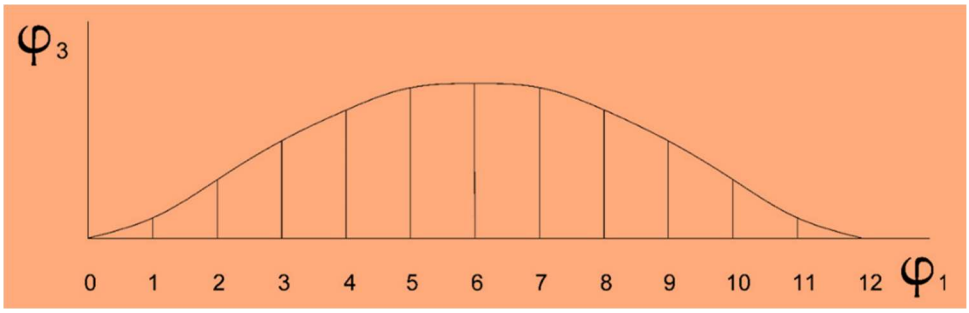


fig. 6

If we give different values to the turning angles of the curve, that is, we divide the corresponding circumference into several (in our case 12) equal parts, then we get different locations of the mechanism, thereby determining the locations of the C D ring. The above-mentioned operation can be repeated 12 times, after which, taking into account the appropriate data, it is possible to use the diagram $\omega_3 = \omega_3(\omega_1)$ construction. We can show the obtained results graphically and build a diagram.Let's solve the same task using the computer program AutoCAD.

It should also be noted that the graphical methods of determining the location function of spherical mechanisms, which is the main problem in solving both analysis and synthesis problems, can also be solved by various digital approaches today [4].

As we have already mentioned, the base of the segment defined by vertex B and BC is needed, as well as the base of the segment defined by vertex D and CD. The point of intersection of the bases of the segments (circles) will be the search point C. First, in the computer program AutoCAD, we will build a sphere with a unit radius, then we will mark the standing points A and D. _ The segments can be replaced by cones of rotation whose vertices will be points B and D, axes of rotation BO and DO respectively and incisors at given distances BC and CD. Construction of such cones of rotation in the computer program AutoCAD does not represent any difficulty, the intersection of the bases (circles) of these cones gives us two search points C and C*. It is obvious that the true of these two points is chosen based on the sequential location of the mechanism [5-7]. The computer program AutoCAD allows us to determine

the coordinates of any point of the lever mechanism, as well as the distance between them with acceptable accuracy for practice (Fig. 7).

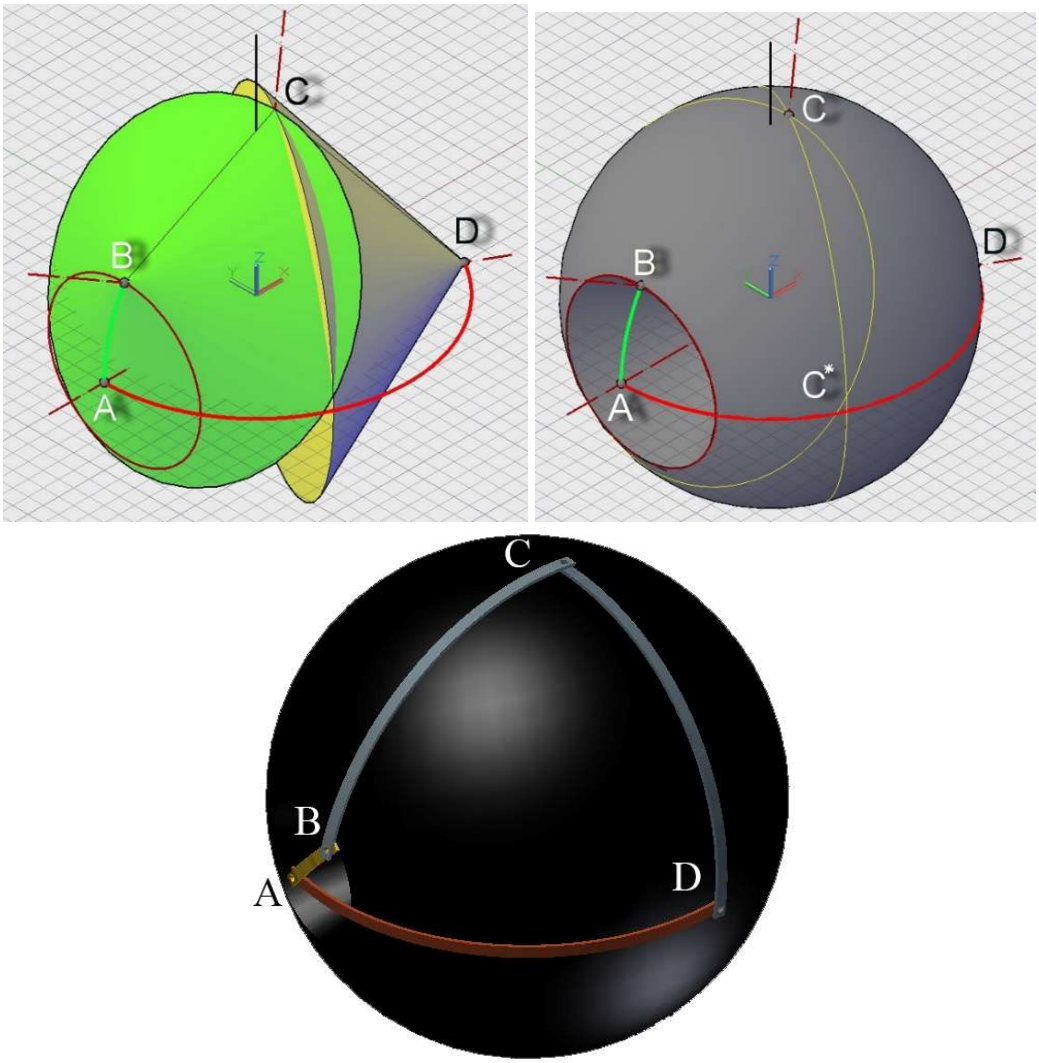


fig. 7

conclusion

Proposed method use allow gives all modification spherical mechanisms kinematic analysis and of synthesis tasks solution to be held same approach based on that each one task solution It gets easier and possible happens his Unification other famous with methods compared to

spherical mechanisms research as a result between fixed and variable kinematic parameters Attitudes allow they give Let's drink issue whole process optimization about.

proposed method allow gives Let's conduct comparative Analysis graphic and kinematic in ways received to the results between, with that it is possible momentarily checked accepted of answers Accuracy.

During the structural and kinematic analysis and synthesis of spatial (spherical) lever mechanisms, due to its visibility, simplicity and visual efficiency, it is advisable to implement (realize) the proposed method in the educational process.

presented method use It is possible of science and technique various in fields such as: topography, geodesy, geology, geography, military business, cosmonautics, seafaring, astronomy, mechanical engineering and other _ with that posed tasks solution happens Engineer - for constructors famous Linear The basics of geometry provisions and computer program using AutoCAD.

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რეზიუმე

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საკვანძო სიტყვები: ანალიზი, სინთეზი, გეომეტრიული ფიგურა, სფერო, ბადურა, ორთოგონალური კოორდინატები.