Volume 2, Issue 4, April - 2024 **ISSN(E):** 2938-3773

IN THEORETICAL MECHANICS, THE ISSUE OF USING A SOFTWARE TOOL TO EXPRESS THE RELATIONSHIP BETWEEN THE CYLINDRICAL COORDINATE SYSTEMAND THE DEKART COORDINATE SYSTEM

Bekmurodova Manzura Bahodir qizi
The Doctoral of Bukhara State University

Abstract
In this work, the problem of increasing students' mastery of the relationship between the cylindrical coordinate system and the dekart coordinate system have been studied. It has been studied that expressing the relationship between coordinates with the help of software is effective in increasing the mastery rate. The importance of improving basic competence of students has been discussed in the course of theoretical mechanics. The matter of how important the use of software training tools in improving basic competence is has been outlined.

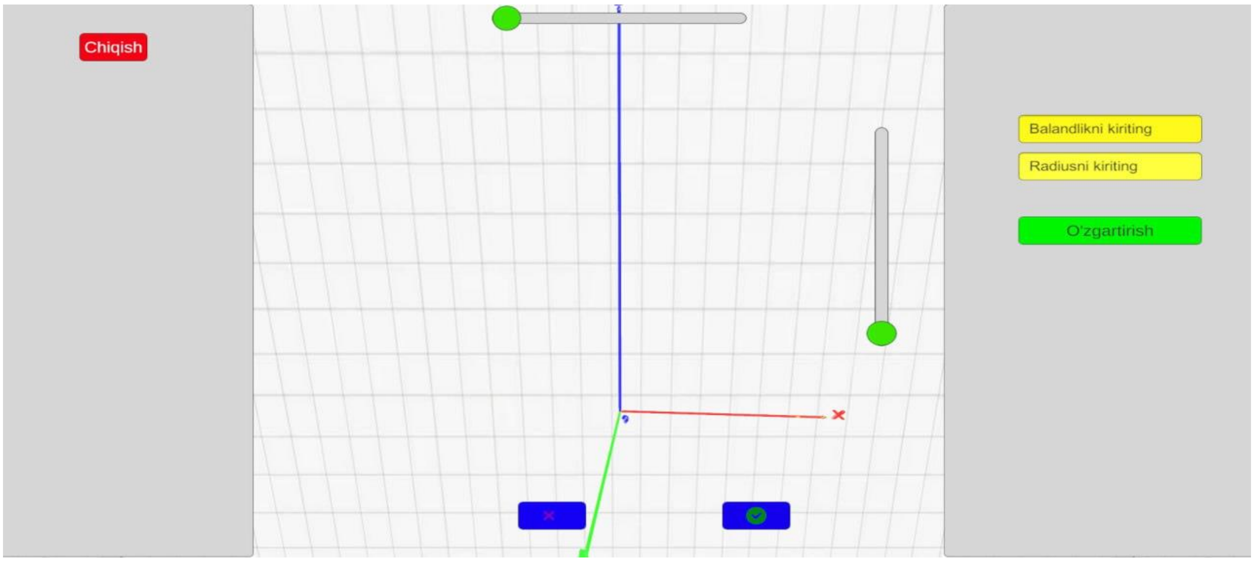
Keywords: basic competence, software educational tool, coordinate system, mastery index.

Introduction

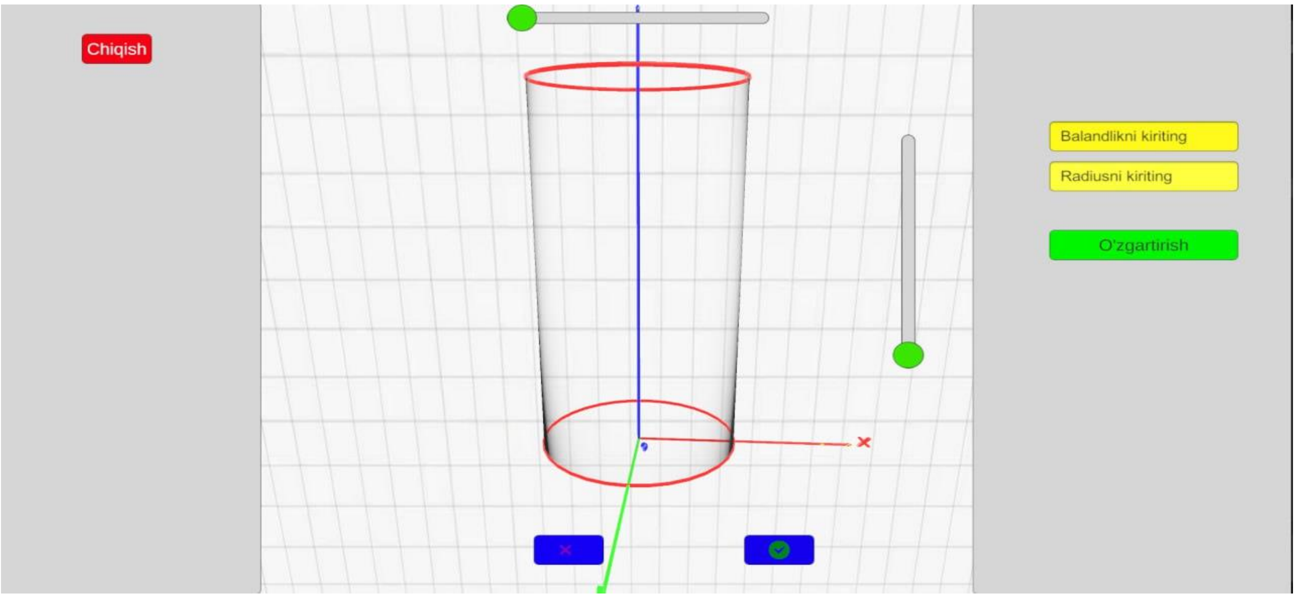
It would not be an exaggeration to say that each era has its own requirements for teaching staff. Today's demand is to educate personnel in our country who are capable of competing in the world market. In order to provide such personnel, every student must be able to master all the subjects in the program sufficiently strong enough. The main role in this is played by the pedagogue along with the student. Because each subject has its own topics and concepts that are difficult to master or that are very important to pay attention to. If we look at it from the point of view of the science of theoretical mechanics, many topics in this science are related to concepts such as the coordinate system, connections between them, speed, acceleration, radius vector. Without understanding the relationships between the coordinate system, the student may not be able to use the necessary concepts in this topic in the following topics or, if not, in other theoretical and practical subjects related to this subject. As an example, the connections between the cylindrical coordinate system and the dekart coordinate system occupy a key place in expressing the momentum vector in theoretical mechanics and in expressing the Lagrange function, which is the most basic function of theoretical mechanics, for different coordinate systems. Therefore, it is not an exaggeration to say that this topic is one of the most basic concepts of science.

But in order to understand the connection between these two coordinate systems, the student must have a complete understanding of vectors and derivatives. In addition, it is appropriate to use the method called "matreshka" and software educational tools to explain this relationship to a student fully. Because if a lesson is conducted in a traditional way, students may have gaps in this topic. In many cases, students have difficulty in understanding the superimposition of two coordinate systems during the lecture of this topic. Because this drawing is required to be drawn with extreme accuracy, and all necessary vectors must be clearly visible in the drawing. Using the program to solve this problem will increase the mastery rate.

In order to solve this problematic situation, I found it appropriate to create a program for superimposing these two coordinate systems by using the "C#" programming language. In this program, each coordinate system, necessary vectors and necessary markings are placed in a certain sequence, that is, in a sequence that is easy to understand. In addition, the colors of lines and necessary markings for each coordinate system are different. This, in turn, makes it possible to easily and clearly express the connections between these two coordinate systems.
First, the student will develop inferences about the Dekart coordinate system. Therefore, the program first creates a Dekart coordinate system, and the coordinates on the axes are marked as x,y,z, and the coordinate beginning is also entered. A dekart coordinate system will be emerged in the monitor in its full state. This view will be explained to the students.

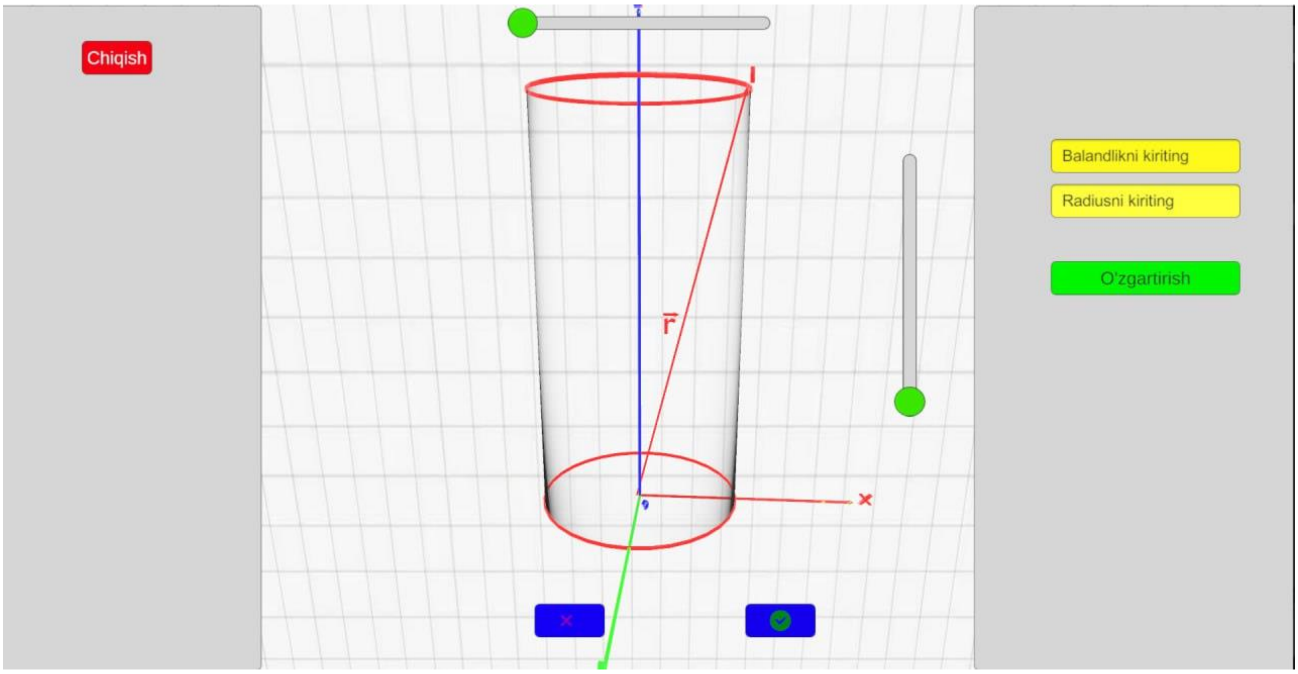


The next task is to draw a cylindrical coordinate system corresponding to the coordinate beginning of the Dekart coordinate system. Both coordinate systems are drawn in two different colors in the program.

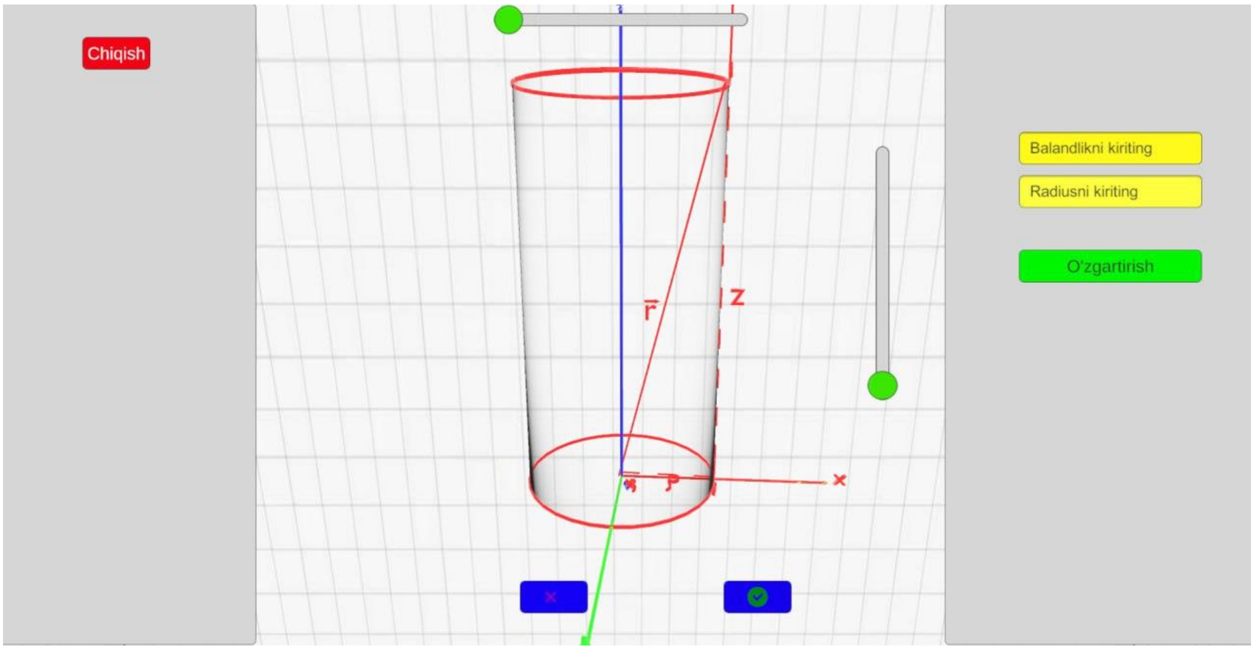


After creating both coordinate systems, we enter the moving point in this drawing. Then we enter the radius vector corresponding to this point.

Volume 2, Issue 4, April - 2024 **ISSN(E):** 2938-3773

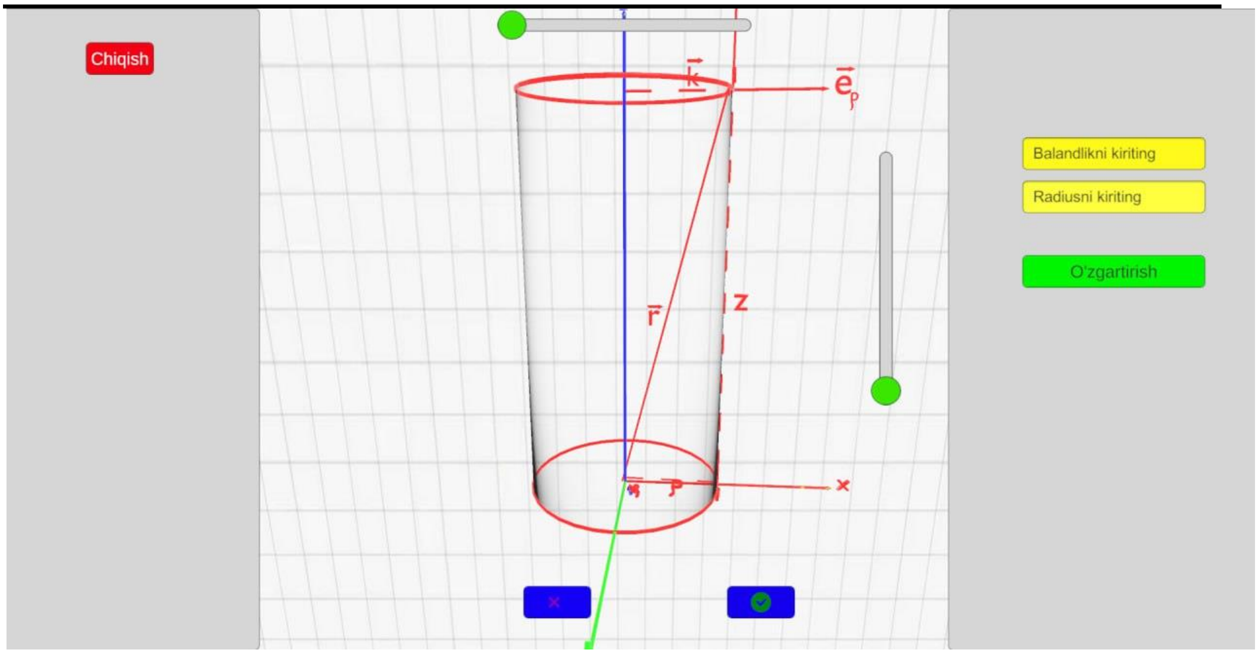


In the cylindrical coordinate system, the position of point M is determined by the coordinates ρ, φ, z Therefore, we now use the program to show these parameters in the drawing, and the drawing will look like the following

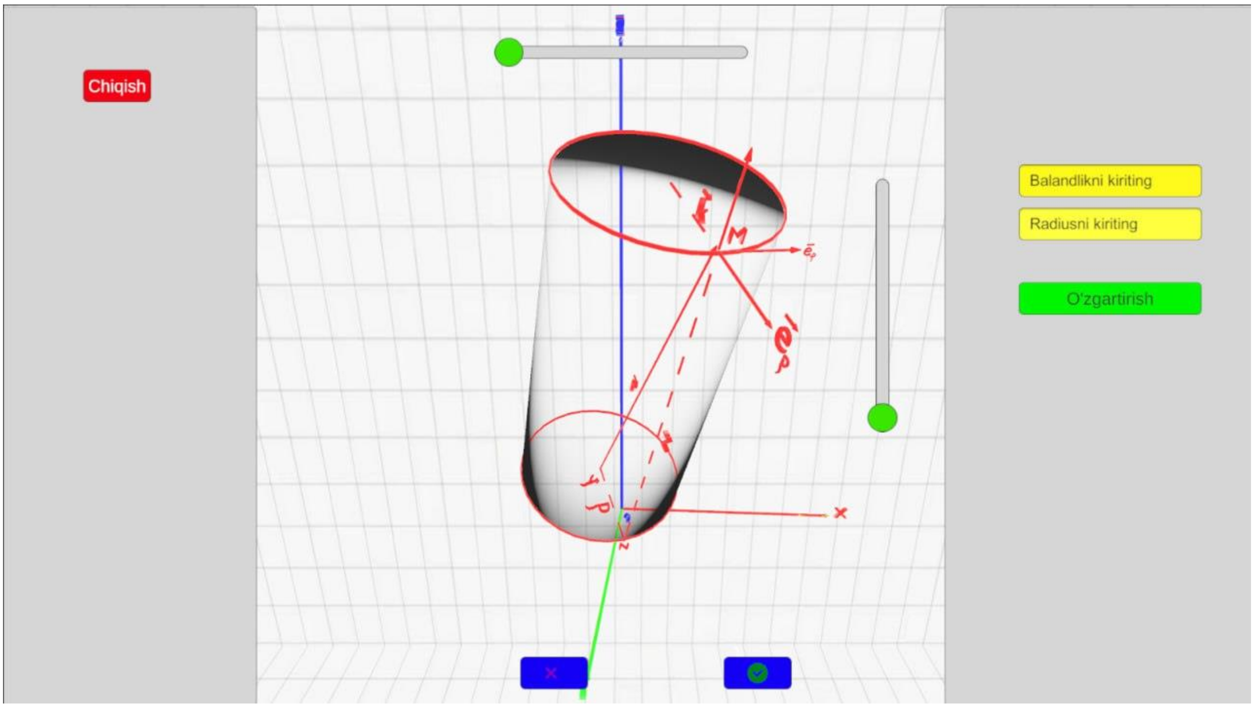


The backs of both coordinate systems play a key role in expressing the connections between the Dekart coordinate system and the cylindrical coordinate system. Now we create the backs of the cylindrical coordinate system in the drawing.

Web of Discoveries: Journal of Analysis and Inventions
webofjournals.com/index.php/3



In order to form a $\varphi = \varphi(t)$ connection, the placement of the angle φ is important for us. φ angle is the main dimension. Because it is necessary to know the change of the angle x, y over time in order to express the change of the movement of the point on the x, y axis. Then the state of the drawing will change as follows.



After forming the drawing completely by using the program, the following links are created based on the rules of mathematics.

$$x = \rho\cos\varphi, \quad y = \rho\sin\varphi, \quad z = z \qquad (1)$$

$$\vec{r} = \rho \cdot \vec{e}_{\rho} + z\vec{k}, \quad r = \sqrt{\rho^2 + z^2}, \quad \rho = \sqrt{x^2 + y^2} \qquad (2)$$

Web of Discoveries: Journal of Analysis and Inventions
webofjournals.com/index.php/3

In order to find the connection between the backs of the cylindrical coordinate system $\vec{e}_\rho, \vec{e}_\varphi$ and the Dekart coordinates $\vec{i}, \vec{j}$, we equate expressions of $\vec{r}$ radius-vector systems in both systems (2) and, taking (1) into account, we get the following connections as a result:

$$\vec{r} = x\vec{i} + y\vec{j} + z\vec{k} = \rho \cdot \vec{e}_\rho + z\vec{k}$$

$$x\vec{i} + y\vec{j} = \rho \cdot \vec{e}_\rho \qquad \rho \cdot \vec{e}_\rho = \vec{i}\rho\cos\varphi + \vec{j}\rho\sin\varphi \qquad (3)$$

The direction of the backs of the cylindrical coordinate system changes depending on time, so it is necessary to find their derivatives with respect to time.

$$\dot{\vec{e}}_\rho = \dot{\varphi} \cdot \vec{e}_\varphi, \qquad \dot{\vec{e}}_\varphi = -\dot{\varphi} \cdot \vec{e}_\rho \qquad (4)$$

If we take into account equalities (4) in derivatives according to time from the radius vector of the point, we can determine the velocity and acceleration vectors.

$$\vec{v} = \dot{\rho} \cdot \vec{e}_\rho + \rho \cdot \dot{\varphi} \cdot \vec{e}_\varphi + \dot{z}\vec{k}, \qquad v = \sqrt{\dot{\rho}^2 + \rho^2\dot{\varphi}^2 + \dot{z}^2} \qquad (5)$$

$$v_\rho = \dot{\rho}, \quad v_\varphi = \rho\dot{\varphi}, \quad v_z = \dot{z} \qquad (6)$$

Corresponding to it is known as radial, transverse and axial projections of radius vector. Taking derivatives from velocity vector according to time , we will get the following for velocity vector and it's projection:

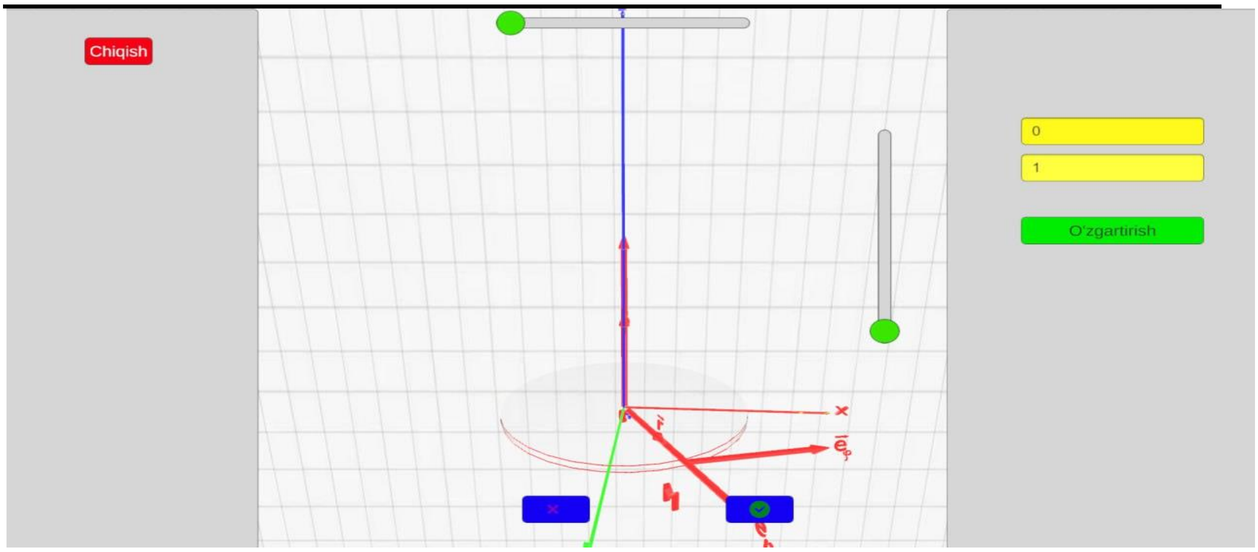
$$\vec{a} = \dot{\vec{v}} = \frac{d}{dt}(\dot{\rho}\vec{e}_\rho + \rho\dot{\varphi}\vec{e}_\varphi + \dot{z}\vec{k}) = \ddot{\rho}\vec{e}_\rho + \dot{\rho}\dot{\varphi}\vec{e}_\varphi + \dot{\rho}\dot{\varphi}\vec{e}_\varphi + \rho\ddot{\varphi}\vec{e}_\varphi - \rho\dot{\varphi}^2\vec{e}_\rho + \ddot{z}\vec{k}$$

$$\vec{a} = (\ddot{\rho} - \rho\dot{\varphi}^2)\vec{e}_\rho + (2\dot{\rho}\dot{\varphi} + \rho\ddot{\varphi})\vec{e}_\varphi + \ddot{z}\vec{k} \qquad (7)$$

$$a_\rho = \ddot{\rho} - \rho\dot{\varphi}^2, \qquad a_\varphi = 2\dot{\rho}\dot{\varphi} + \rho\ddot{\varphi}, \quad a_z = \ddot{z} \qquad (8)$$

These connections can be made clear by a complete understanding of the diagram. As we know, the position of the cylindrical coordinate system gives the polar coordinate system. Viewing this point in the computer monitor with the help of the program gives the student a complete impression of this situation. At the same time, the student will have no difficulty in expressing the connections between the Dekart coordinate system and the polar coordinate system.

Web of Discoveries: Journal of Analysis and Inventions
webofjournals.com/index.php/3



In a word, the first condition for correctly expressing the connections between the coordinate systems is to correctly understand the diagram in which the coordinate beginnings superimpose . The above program created using the "python" programming language will be a good helper to solve this problem. When students learn the above topic with the help of this program, they record a high mastery rate and, most importantly, they can apply the learned concepts correctly in the necessary conditios.

References

1. Saidov.Q.S. , Bekmurodova.M.B. Complex movement of object // International Scientific Journal 85:5 (2020), pp. 316-322
2. Saidov.Q.S. , Bekmurodova.M.B. The problem of teaching heat transfeer and heat exchange in schools and lyceums // JournalNX-A Multidisciplinary Peer Reviawed Journal 6:9 (2020), pp. 176-183
3. Саидов К. С., Бекмуродова М. Б. К. Проблема преподавания теплопроводности и теплообмена в школаХ //Наука, техника и образование. – 2021. – №. 2-1 (77). – С. 38-41.
4. S Qurbon, B Manzura nuqtaning impuls momentini slindrik koordinatalar sistemasida isodalashning yangi pedagogik usullari //Involta Scientific Journal,1:6 (2022), s.113-119
5. S.K. Sayfulloevich , M.B.Bekmurodova. Using the methods of" matryoshka" and" consecutive contraction" to explain the theory of motion of a material point//Open Access Repository 8:04 (2022) pp.67-70.
6. Saidov.Q.S. , Bekmurodova.M.B. He problem of teaching heat transfeer and heat exchange in schools and lyceums // JournalNX-A Multidisciplinary Peer Reviawed Journal 6:9 (2020), pp. 176-183
7. M.B.Bekmurodova, Maddalarning tuzilishiga oid tushunchalarni yoshga xos xususiyatlarni hisobga olgan holdainterfaol metodlar yordamida tushuntirish, Центр научных публикаций (buxdu. uz): Том 1 № 1 (2020)
8. M.B. Bekmurodova Issiqlik uzatilishi va issiqlik almashinuvi jarayonlarini o'qitish metodikasi, Центр научных публикаций (buxdu. uz),Том 1 № 1 (2020)

Web of Discoveries: Journal of Analysis and Inventions
webofjournals.com/index.php/3

9. S Qahhorov, M Bekmurodova . Use of interactive methods in expressing motion equations in different coordinate systems// Science and innovation 2:A6 (2023), pp.19-24
10. Kakhkharov S.K., Juraev K.O., JamilovY.Y., Xudoyberdiyev S.B. // Journal of Contemporary Issues in Business and Government (2021) 27 PP 744-751.
11. Kakhkhorov S.K, Juraev H.O Modeling of heat-physical processes in solar dryers// journal of critical reviews. vol 7, issue 17, (2020) pp 9-15
12. Каххоров С.К., Рахматов И.И., Мухаммедов Ш.М. Особенности построения образовательного процесса на основе модульных технологий обучения в узбекистане // Вестник науки и образования (2020) № 18(96) Часть 2 С 33-36.
13. Muhammadova D.A. Development of Students' competence in working with information in physics lessons. // A German Journal World Bulletin of Social Sciences An International Journal Open Access Peer Reviewed scholarexpress.net ISSN (E): 2749-361X Journal Impact Factor: 7.545. VOLUME 20, March, 2023,35-39.