Abstract. The article deals with the problems of combining physical and computer modeling in solving theoretical and practical problems in the course of physics. Computational physics, that is often defined as a branch of theoretical physics, is used to describe the physical processes studied in mechanics and magnetism. We give the examples of the use of Mat lab and Excel, and the Java programming language for creating spatial models of magnetic fields in solving problems. The presented material is a generalization of the experience of introducing elements of computational physics into the educational process in universities. In the modern times, the information about the world around us is spreading as widely as possible. Therefore, in connection with this, computer science and new information technologies occupy a special place in many professional activities, including teaching students in higher educational institutions. The article deals with the issues of improving the quality of training of future specialists in the system of higher education in accordance with modern requirements for the development of Kazakhstani education.

Keywords. Methodology of the physical sciences, approaches to learning, physical understanding, education, training, competence, methodology.

Introduction.

With the development of modern technologies and computerization of all spheres of life, including science, computing using computers has become an integral part of work in many areas, including physics. Modern physical calculations, especially in complex and multilevel systems, require high accuracy and scale, which is often impossible to do without using a computer.

In universities, physical calculations on a computer are one of the important components of the educational process. Physics students use the computer to create mathematical models, numerical analysis, simulation and data visualization, which allows them to improve their knowledge and skills in the field of physics, as well as prepare for a future career in the scientific field.

The purpose of this work is to consider the methods of physical calculations using a computer, which are used in universities, as well as their practical application.

Armed with the knowledge of variables, constants and keywords, the next logical step is to combine them to form instructions. However, instead of this, we would write our first Java program now. Once we have done that we would see in detail the instructions that it made use of. Before we begin with our first Java program, do remember the following rules that are applicable to all Java programs:

(a) Each instruction in a Java program is written as a separate statement. Therefore, a complete Java program would comprise a series of statements.

(b) Blank spaces may be inserted between two words to improve the readability of the statement. However, no blank spaces are allowed within a variable, constant or keyword [1].
Materials and methods.

Informatization of education in higher educational institutions opens the way to solve key problems of social, economic, theoretical and practical nature. That is why it is necessary to scientifically base and put into practice new teaching methods for training students as highly qualified specialists.

Computerization of the educational process is the only way to optimally solve these problems. Because the formation of the basics of information culture in future specialists is closely related to the fact that they work on a computer from an early age and then master it well.

The process of mass introduction of computerization in higher educational institutions of general education poses new scientific problems to the theory of teaching and school practice. In this regard, many scientists and methodologists are conducting theoretical and methodological researches for the purpose of qualitative and effective use of computers in the educational system.

The problems of the impact of the computer on the mental development of students (B.F. Lomov, K.M. Gurevich, etc.), and the problems of organizing students' learning activities in working with a computer (V.V. Rubtsov) have also begun to be studied.

Task 1.

When the particles are 13.7 mm apart, a charged particle A pulls a charged particle B with a force of 2.62 mN to the right. Particle B moves away from particle A directly, separating them by 17.7 mm. Then, what vector force does it apply to A? [2]

Solution by Java

```java
package Chapter23;
public class Exercise_31_4 {
    public static void main(String[] args) {
        System.out.println("In the first situation, F(A on B) = (ke |qA| |qB|) / r1^2 = i. In the second situation, " +
                           "F(A on B) = (ke |qA| |qB|) / r2^2 = -i");
        System.out.println("The process of mass introduction of computerization in higher educational institutions of general education poses new scientific problems to the theory of teaching and school practice. In this regard, many scientists and methodologists are conducting theoretical and methodological researches for the purpose of qualitative and effective use of computers in the educational system.

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Solution by Java

```
Task 2.

Figure P23.12 depicts a straight line where the three point charges $q_1 = 6.00$ mC, $q_2 = 1.50$ mC, and $q_3 = 22.00$ mC are located. They are $d_1 = 3.00$ cm and $d_2 = 2.00$ cm, respectively. Determine the strength and direction of the net electric force acting on $q_1$ (a), $q_2$ (b), and $q_3$ (c) [2].

Solution by Java.

```java
package Chapter23;
public class Exercise_23_12 {
    public static void main(String[] args) {
        //charges
        double q1 = 6.00 * Math.pow(10, -6);
        double q2 = 1.50 * Math.pow(10, -6);
        double q3 = -2.00 * Math.pow(10, -6);

        //distances
        double d1 = 3.00 * Math.pow(10, -2);
        double d2 = 2.00 * Math.pow(10, -2);

        double electricForce1 = Double.parseDouble(electricForce(q1, q2, d1));
        double electricForce2 = Double.parseDouble(electricForce(q1, q3, distance d1 + d2));
        double electricForce3 = Double.parseDouble(electricForce(q2, q3, d2));
        System.out.println("F1 = " + electricForce1 + " N");
        System.out.println("F2 = " + electricForce2 + " N");
        System.out.println("F3 = " + electricForce3 + " N");
        System.out.println();

        System.out.println("F(q1) = F1 - F2 = " + String.format("%.1f", electricForce1 - electricForce2).replace("target", ", replacement": ") + " N");
        System.out.println("F(q2) = F1 + F3 = " + String.format("%.1f", electricForce1 + electricForce3).replace("target", ", replacement": ") + " N");
        System.out.println("F(q3) = F2 + F3 = " + String.format("%.1f", electricForce2 + electricForce3).replace("target", ", replacement": ") + " N");
    }
    public static String electricForce(double qFirst, double qSecond, double distance){
        double k = 9.09 * Math.pow(10, 9);
        double electricForce = (k * Math.abs(qFirst) * Math.abs(qSecond)) / Math.pow(distance, 2);
        String s = String.format("%.1f", electricForce);
        s = s.replace("target", ", replacement": ");
        return s;
    }
}
```
Solution by Matlab.

```matlab
>>
q1 = 6.000e-6;
q2 = 1.500e-6;
q3 = -2.000e-6;
d1 = 3.000e-2;
d2 = 5.000e-2;
d3 = 2.000e-2;
k = 8.99e9;

F1 = k * abs(q1) * abs(q2) / d1^2;
F2 = k * abs(q1) * abs(q3) / d2^2;
F3 = k * abs(q2) * abs(q3) / d3^2;
F6 = F1 - F2;
F15 = F1 + F3;
F21 = F2 + F3;

rounded_F1 = round(F1, 1);
rounded_F2 = round(F2, 1);
rounded_F3 = round(F3, 1);
rounded_F6 = round(F6, 1);
rounded_F15 = round(F15);
rounded_F21 = round(F21);

disp(['Result: F6 = ', num2str(rounded_F6), ', F15 = ', num2str(rounded_F15), ', F21 = ', num2str(rounded_F21)]);
Result: F6 = 46.7, F15 = 157, F21 = 111
```

Task 3.

A horizontal insulating rod of length d is attached at its opposite ends with two tiny beads that have charges q1 and q2 of the same sign. The origin is the bead with charge q1. A third tiny, charged bead is free to slide on the rod, as seen in Figure P23.13. (a) Where on the x-axis does the third bead reach equilibrium? [2]
Solution by Java.

```java
package Chapter25;

public class Exercise_25_14 {
    public static void main(String[] args) {
        double distance = 2.00 * Math.pow(10, -2);
        double charge1 = -15.0 * Math.pow(10, -9);
        double charge2 = 27.0 * Math.pow(10, -9);
        String elPotA = electricPotential(distance, charge1, charge2);
        System.out.println("(a) The electric potential at point A is " + elPotA + " kV");
        String elPotB = electricPotential(distance/2, charge1, charge2);
        System.out.println("(b) The electric potential at point B is " + elPotB + " kV");
    }

    public static String electricPotential(double distance, double charge1, double charge2){
        double k = 8.99 * Math.pow(10, 9);
        double elPot = k * (charge1 / distance + charge2 / distance) / 1000;
        String s = String.format("%.2f",elPot);
        s = s.replace( target: ",", replacement: ".");
        return s;
    }
}
```

Solution by Matlab.

```matlab
>> q1 = -15.0e-9;
q2 = 27.0e-9;
r = 2.00e-2;
k = 8.99e9;

V = k * (q1 / r + q2 / r) / 1000;
r2 = r/2;
V2 = k * (q1 / r2 + q2 / r2) / 1000;

rounded_V2 = round(V2, 1);

disp(['The electric potential at point A is ', sprintf('%.2f', V), ' kV']);
disp(['The electric potential at point B is ', num2str(rounded_V2), ' kV']);
The electric potential at point A is 5.39 kV
The electric potential at point B is 10.8 kV
>>
```
Results and discussion.

Grades distribution for Fall 2020

Grades distribution for Spring 2021

Grades distribution for Spring 2022

Grades distribution for Spring 2023
Analysis of Student Grade Distribution Over the Past Four Years

The presented tables depict the distribution of student grades from spring 2020 to spring 2023. An examination of this data reveals significant changes in the overall profile of student performance over the last two years.

In spring 2020, there was a dominance of grades ranging from C+ to B-, with C+ being the most prevalent grade (32.34%). However, from 2021 to 2022, a consistent trend of improvement in results was observed, reflected in higher percentages of A and B grades, a decrease in the proportion of C+, and a reduction in unsatisfactory outcomes.

The notable increase in the percentage of A and A- grades in spring 2022, totaling 12.66%, was particularly encouraging. In the latest reporting period, spring 2023, while there is a slight decrease in the percentage of top grades A and A-, it still significantly surpasses the data from 2020.

The noticeable enhancement in the quality of student performance over the past two years underscores the efficacy of applied educational methods and strategies. Such a positive trend indicates the growth of academic achievements among the student body and the effectiveness of teaching approaches within this educational institution.

These data underscore the successful development of the educational program and confidently affirm an elevation in the overall level of student performance at the university over the past two years.

The problems generated in the physics practical computer java program increased the interest of the students. The quality of progress of students in the subject of physics increased according to the teaching method. It can be seen by looking at the graph of the last two years. The results obtained there show that the academic performance of students in 2021 is high and the quality of performance in 2022 is high. Students' knowledge, flexibility (dexterity), skills were checked and evaluated.

The method of teaching physics made sure of the effectiveness of creating a physical calculation with the program based on the example of computer calculation tasks (electrical phenomena, Coulomb's law, etc.).

Conclusion.

In conclusion, the utilization of computer-assisted methods in solving physics problems marks a new and promising trajectory in the pedagogy of higher education physics. Presently, the practical implementation of these methods necessitates a systematic integration of relevant theoretical frameworks. As articulated within this article, the application of computer-aided problem-solving methods is not limited to the realm of physics alone but extends to the teaching processes across various subjects, amplifying its significance.

The integration of the Java programming language in tackling physics problems serves as a valuable tool for students, fostering the development of a broader perspective. Physics, as an experimental science, derives its foundational knowledge from empirical experiences rather than mere contemplation. The formulation of even the most basic physical laws necessitates the creation of a physical model, abstracting insignificant features from objects or phenomena. Without such models, comprehension, generalization, or elucidation of the essence of natural phenomena becomes unattainable. In essence, without a model, science devolves into a disjointed collection of inexplicable facts rather than a coherent theory.

The construction of knowledge proves fruitful when intertwined with the cultivation of educational and cognitive skills. This guide not only facilitates the acquisition and utilization of information but also aids in the creation and manipulation of simple models, allowing a profound understanding of their applicability boundaries.

The methods elucidated in this article underscore the symbiotic relationship between computational techniques and the comprehension of physics, highlighting their pivotal role in advancing both educational methodologies and problem-solving capacities across academic
disciplines. As we embrace these methodologies, their broader implications extend beyond physics, shaping the landscape of multifaceted learning paradigms in diverse domains of education.

REFERENCES


REFERENCES*


Кобінесе теориялық физикасы бір саласы ретінде анықталған есептеу физикасы механика мен магнетизмдегі зерттелетін физикалық процессерді сипаттау үшін колданылады. Есептерді шешуде магнит орістерінің кеңістікінің модельдерін құру үшін Mat lab және Excel, сондай-ақ Java бағдарламаларының тілін колдану мысалдары келтірілген. Усынылған материал университеттердегі оқу процесіне есептеу физикасының элементтерін енгізу тәжірибесін жалпылау болып табылады. Қазірғі заманда біздің коршаған элемент тұралы ақпарат мүмкін болмаса, олар қандайға тарату үшін Mat lab және Excel, сондай-ақ Java бағдарламаларының тілін колдануы мүмкін. Материал адамдарға проблемалық түрде оқуға қолданылады. Материалдың жылықтырылуы әдістеме және тәсілдерге қосылған элементтер болады.