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IAR project

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ABSTRACT. *In the research, I create an ideal environment by using software-blender to imitate it. My researching purpose is to use physical form to represent the common movement in our life. Modeling makes me to have a better way to illustrate the research detailed.*

Introduction

In the research, I designed the layered structure to make the experiment more ornamental and realistic. The experiment needs several kinds of tools like the slopes and planes to help make the motion much more real than we thought.

In the experiment, I make a lot of layers to make the experiments not only interesting but also more real. The rest ball is located above the plane about 80centimeter, and it will slide down after starting the research. Then, after several seconds, it will hit the balls in the third floor. By giving certain amounts of force, the balls in the first floor will move with different velocity.

$$(m1v1) = (v2m1) + (v3m2) + (v4m3)_{:}$$

Where m1 is the mass of the balls in the highest altitude, v1 is the velocity of that balls. m3, m2...refer to the mass of other balls in the first floor. v1v2v3v4 refers to the velocity of the all balls before and after the collision. After the collision in the first floors. One of the balls in the first floors will drop down along the slope and hits the balls in the second layers. After that the balls in the second floor will have the same condition as I mentioned in the first layers. At last, one of the balls will drop to the third oor and hit our nal target: a simple ball.

I think that research is meaningful for us since it starts in a special point that we all familiar with that kinds of motion, but we never pay a lot of attention about it.

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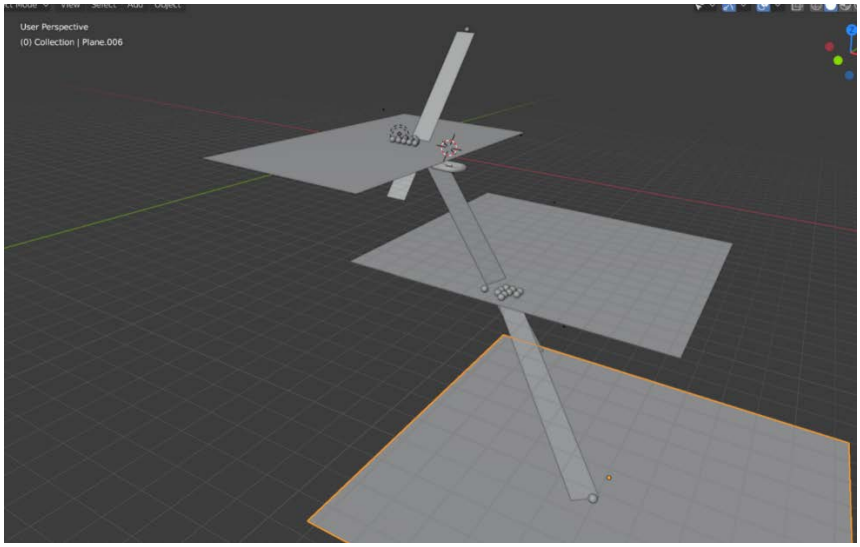

Method

Control virable :

1. altitude of the first ball

Reason: the altitude of the ball decides the velocity of the ball that hits the balls in the first layer. If we cannot control the velocity very well, it will distrub the whole research. For example, the ball in the first layer may not be able to hit the balls in the second layer and third layer. As a result, the whole research are disrupted.

2.the mass of the first ball

Reason: the amount of mass will affect the kinetic energy it hits the first layer.If the mass is too small, we cannot make the ball hits the balls in the first layer. If the mass is too large, we will make the balls in the first layer unable to hit the balls in the second and third layers.

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3.the mass of other balls

Reason: if others balls' mass are too large, we cannot make sure that the ball on the first layer will hit the balls in the second layer, since they may not move a enough distance. But if the mass is too small, they are not able to make the balls in the second layers move a enough distances.

Summary: all the three variables make a big influence and a huge contribution to the whole research.

data

Altitude:	Top :83.7 : First layer:0 Second layer:-73.1 Third layer:-131.6
mass	Top: 18kg First layer: 0.1kg Second layer:0.01kg Third layer: 0.001kg

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Friction coffecient	All 0.5

1 Setting:

1,highest ball

a dynamic ball

mass:18kg

Rigid body:active

Shape: convex hull

2 other ball

All the same except mass

3 plane

A unchange object

Mass: unneed

Rigid body: passive

(all the setting above according to the parameter of blender)

Analysis by using tracker

What is tracker:

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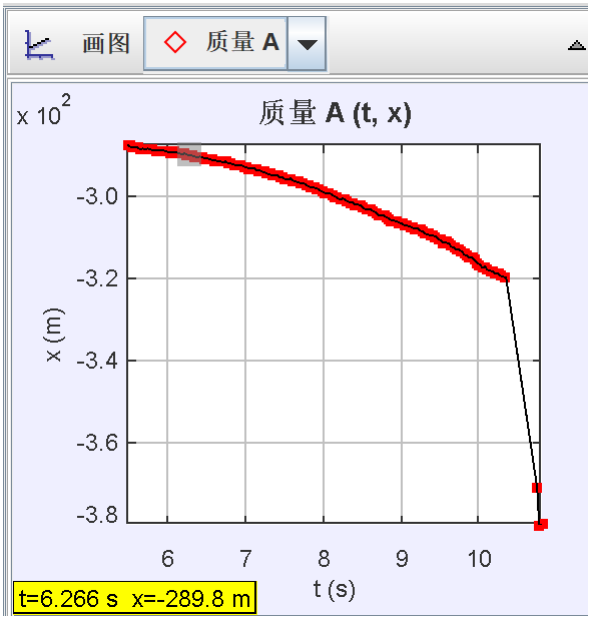
Tracker is a physical image analysis and modeling tool You can convert the spatial data collected in video to the software, and you can customize a space-time coordinate system, which will enable you to edit the two-dimensional diagram of the video by tracking the motion trajectory, making it easier for you to analyze spatial data.

Analysis of the highest ball



Analysis of the ball that hit the second layer's ball

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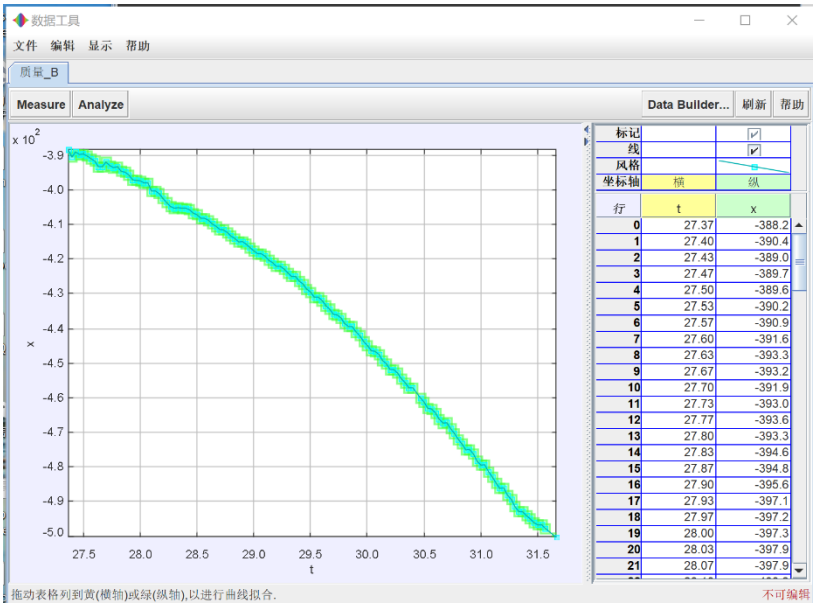
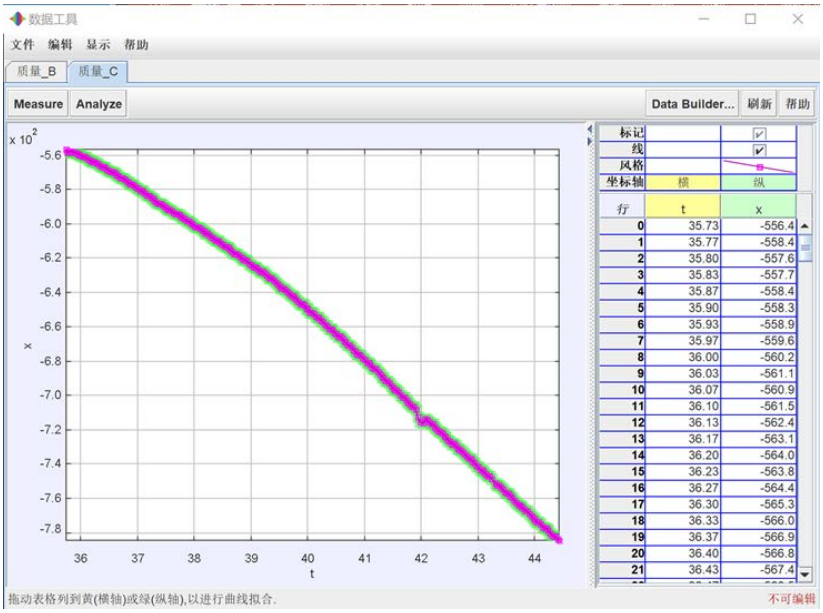


the third ball is the ball slides to the third layers.



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Theoretical Analysis

1 energy conservation law

Introduction: In physics and chemistry, the law of conservation of energy states that the total energy of an isolated system remains constant; it is said to be conserved over time.[1]

The law of conservation of energy is a fundamental law of nature.It means In a closed system, the total energy of the system remains the same.

It means that energy can neither be created nor destroyed; rather, it can only be transformed or transferred from one form to another. For example, in my research, the energy amount is all constant, the ball from the highest point slides to the lowest point—the gravitation potential energy change to the kinetic energy.

In the science of conservation of energy, the law of conservation of energy is accounted for ruling and leading position .Other laws will be derived by the law of conservation of energy, or verified by the law of conservation of energy .In this paper four questions are discussed .The relationship between force and mass, velocity is reconsidered according to the law of conservation of energy ;Other laws such as the law of gravity and law of Coulomb are re-derived ;Other laws will be verified that whether or not they can be used, and an example that the law of conservation of momentum and the law of conservation of angular momentum are not correct (the results given by

them are contradiction with the law of conservation of energy) ;Changing an old subject into a new subject .For example, changing Newton ’s mechanics into New Newtons mechanics ;New Newtons mechanics can be used for partly replacing relativity and solving the problem which can not be solved by relativity .In the science of conservation of energy, the dominant is The law of conservation of energy. For all problems related to energy the law of conservation is the only true truth;Other laws, or you can derived from the law of conservation of energy, or subject to conservation of energy. Or the test of the law is wrong.

According to the law of conservation of energy, some old disciplines can be transformed become a new discipline. For example, within the framework of classical mechanics, Newtonian mechanics is transformed into new Newtonian mechanics . New Newtonian Mechanics Main Package include five laws: source law, improved law of gravitation and improvement.The three laws of motion. Where the law of conservation of energy is taken as the new Newtonian .The source law of mechanics, according to the source law, an improved universal gravitional law .The law and the law of universal gravitation are summarized based on the experimental results, In order to explore the possibility of theoretically deriving these two laws according to

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the law of conservation of energy, for an instance of constrained motion (a small ball Roll down along a long inclined surface), while performing an improved Newton second Law and the law of gravitation. New Newtonian mechanics can handle the problem of Mercury's perihelion precession and perihelion deflection problems, thus it can partially replace the theory of relativity. The result is a small deviation from the result of relativity, defined by new Newtonian mechanics

The third-order gravitational formula of can get exactly the same as the experimental results.[2]

Apply in project(finding the velocity and such things)

2 Newton Second law

The second law states that the rate of change of momentum of a body is directly proportional to the force applied, and this change in momentum takes place in the direction of the applied force.

Newton perceived that the object's velocity will change A net force exerted on an object may make its velocity increase. Or, if the net force is in a direction opposite to the motion, that force will reduce the object's velocity. If the net force acts sideways on a moving object, the direction of the object's velocity changes. That change in the direction of the velocity is also an acceleration. So a sideways net force on an object also causes acceleration. In general, we can say that a net force causes acceleration.

$$F = ma$$

[3]Apply in the research :(calculate the force apply on each ball)

3 acceleration

In mechanics, acceleration is the rate of change of the velocity of an object with respect to time. Accelerations are vector quantities.

Average acceleration

An object's average acceleration over a period of time is its change in velocity divided by the duration of the period.

Other forms

An object moving in a circular motion—such as a satellite orbiting the Earth—is accelerating due to the change of direction of motion, although its speed may be constant.

Related fromula:

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$$a = \frac{F}{m}$$

$$a = \frac{s}{t}$$

$$v = V0 + at$$

$$S = v0 + v0t + \frac{at^2}{2}$$

Circulation motion

$$a = \frac{v^2}{r}$$

$$V = wr$$

Apply in the project: a variable that relate to the objects motion

4 Potential energy

Potential energy is the energy associated with forces that depend on the position or configuration of an object (or objects) relative to the surroundings.

Various types of potential energy (PE) can be defined, and each type is associated with a particular force.

1）gravitational potential energy

Perhaps the most common example of potential energy is gravitational potential energy

Gravitational potential energy depends on the vertical height of the object above some reference level

Potential energy belongs to a system, and not to a single object alone. Potential energy is associated with a force, and a force on one object is always exerted by some other object. Thus, potential energy is a property of the system as a whole. For an object raised to a height y above the Earth's surface, the change in gravitational potential energy is mgy. The system here is the object plus the Earth, and properties of both are involved: object (m) and Earth (g).

There are other kinds of potential energy besides gravitational. Each form of potential energy is associated with a particular force, and can be defined analogously to gravitational potential energy. In general, the change in potential energy associated with a particular force is equal to the negative of the work done by that force when the object is moved from one point to a second point

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2）Potential Energy of Elastic Spring

The spring has potential energy when compressed (or stretched), because when it is released, it can do work on a ball as shown. To hold a spring either stretched or compressed an amount x from its natural (unstretched) length requires the hand to exert an external force on the spring of magnitude which is directly proportional to x. That is,

$$Fe = kx,$$

3） Potential Energy as Stored Energy

In the above examples of potential energy—from a brick held at a height y, to a stretched or compressed spring—an object has the capacity or potential to do work even though it is not yet actually doing it. These examples show that energy can be stored, for later use, in the form of potential energy. Note that there is a single universal formula for the translational kinetic energy of an object, but there is no single formula for potential energy. Instead, the mathematical form of the potential energy depends on the force involved.[4]

5 put all parameter and data into the research

First, by using the Newton Second law, we can calculate the amount of the kinetic energy given by the highest ball that is 18kg times the angle of the plane-cosx ,times the acceleration. That's the total kinetic energy.

Second, after we know the force that act on the highest layer, we can analysis the layer in the first layer. By measuring the velocity and mass of the balls after highest ball hit the balls in the first layer, we know the enough data.

$$(m1v1) = (v2m1) + (v3m2) + (v4m3) + \ldots\ldots$$

(be careful, since before the collision, the velocity of all the other ball is zero, and after the collision, the quantity of the highest should also be included after hitting the ball and the velocity is not constant. Another point you need to pay attention is that since the application point is not the same at the different ball, the result will also lead to a different motion.)

After they move, one of the balls will slide along the plane into the second layer. After that, it will lead the same collision like the first layer.

In fact, the balls that in the third layer plays the role as a target for the research to achieve, by using a simple ball in the third layer, we can analysis the motion in a better way.

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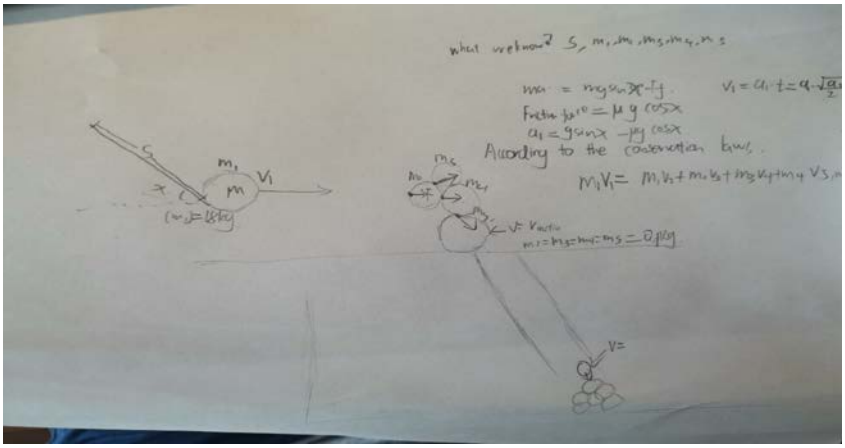

6 Conclusion

I think the research is very meaningful for me. Although it no includes the cutting-edge technology, but we can use the knowledge we have to make an analysis that familiar with our daily life. The Newton Second law, The Conservation of energy, the acceleration, the potential energy. The motion itself is very funny and basic. It just like a sport called snooker ball.

I think the research is little simple and the data is not able to make the research seems to be very rich since it is not enough. However, I want to mention something that I can imagine according to the research.

particle accelerator：A particle accelerator is a machine that uses electromagnetic fields to propel charged particles to very high speeds and energies, and to contain them in well-defined beams.[5]

In the research, each of the ball represent a particle that have a close meaning since the collision between the balls just like the collision of particle.

References

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[2] Fu YuHua Journal of Dezhou University 2004 .12
[3] DOUGLAS C. GIANCOLI PHYSIC chapter Newton second law
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