ФИЗИКО-МАТЕМАТИЧЕСКОЕ ОБРАЗОВАНИЕ: ЦЕЛИ, ДОСТИЖЕНИЯ И ПЕРСПЕКТИВЫ

PHYSICAL AND MATHEMATICAL EDUCATION: GOALS, ACHIEVEMENTS AND PROSPECTS

Материалы Международной научно-практической конференции

г. Минск, 10–13 мая 2017 г.

Materials of the International Scientific and Practical Conference

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эффективными являются два пути снижения уровня воздействия электромагнитного поля мобильного телефона на мозг пользователя [1].

Первый путь – «защита временем», т. е. надо, как только можно, сокращать длительность разговора по мобильному телефону, диалог должен быть кратким.

Второй путь – «защита расстоянием». Снижение интенсивности ЭМП падает по квадрату расстояния, поэтому увеличение расстояния нахождения мобильного телефона по отношению к голове пользователя даже на 1–2 см значительно снижает интенсивность воздействия на мозг.

Поэтому часть советов можно сделать исходя из этих двух принципов защиты, хотя существует и ряд других достаточно эффективных рекомендаций.

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DEMONSTRATION NUMERICAL EXPERIMENT ON THE DYNAMICS OF ROTATIONAL MOVEMENT BY MEANS ANIMATIONS IN SHOCKWAVE FLASH FORMAT

Electronic processing systems are possible to strengthen the didactic component of the perception of the material and simultaneously cover several aspects of the presentation and fixing of the physical phenomenon under consideration, that is,

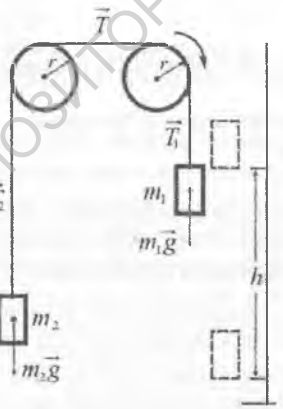
– display in real time physical processes and their features, which in the form of animation models are displayed on the monitor or interactive whiteboard, including when varying some of the original parameters

– perform collective calculations based on the data recorded in the virtual screen experiment, as well as distribute the simulated results of the numerical experiment among students with subsequent individual calculation and public protection in the mode of the colloquium when comparing the results for different participants.

– to provide electronic laboratory work for students on their gadgets with the possibility of self-assimilation of the covered process through numerical modeling of the physical phenomenon and restoration of the required parameters and characteristics.

– directly display the course of the laboratory demonstration lesson outside the faculty in the classrooms of other educational institutions (sponsored schools, gymnasiums) at the conditions of reliability of communication systems.

The report presents the main points of organizing and conducting a laboratory demonstration session on the dynamics of translational and rotational motion using a well-known educational laboratory installation – the so-called Atwood machine. This equipment allows us to consider a wide range of kinematics and dynamics problems, namely, after virtual measuring the time, mass, distance covered by the cargo, it is possible to calculate the acceleration of gravity, the moments of inertia of the blocks, moments of frictional force, block masses, etc. An electronic version of such a work can, in addition to existing laboratory equipment, expand the understanding of the processes due to the flexibility and speed of sampling the parameters of the experiment with instant electronic measurement and fixing the database, which is formed in the course of acquaintance with the processes under consideration. In the electronic version of the work, it is fairly easy to foresee a variation in the experimental and quantitative experimental conditions.



Thus, for the traditional Atwood machine, in the presence of two cargoes conected by a weightless thread and two blocks rotating with friction, the basic system of equations, taking into account the possibility of detecting the acceleration of translational motion through electronic fixation of the time for the passage of arbitrarily varied masses of cargo through a variable height, is

$$m_1 g + \vec{T}_1 = m_1 \vec{a} \quad m_2 g + \vec{T}_2 = m_2 \vec{a}$$

$$\left(\vec{T}_1+\vec{T}\right)r+\vec{M}=I\frac{\vec{a}}{r}\quad\left(\vec{T}_2+\vec{T}\right)r+\vec{M}=I\frac{\vec{a}}{r}$$

$$h=\frac{1}{2}at^2\quad I=\frac{1}{2}mr^2$$

The solution of the system of equations allows to express the acceleration of gravity g, the moment of the frictional force M, the radii of the blocks r, their mass m and the moments of inertia I, and the tension forces of the filaments T_1, T_2 and T. It is possible to use the data of several independent electronic measurements of the passage time t of cargo of height h with the subsequent application of the listed working formulas. Also, based on electronic measurements, it is advisable to plot the dependence of the angular acceleration on the resultant moment.

$$(m_1-m_2)g-2I\frac{a}{r^2}-2M\frac{1}{r}=(m_1+m_2)a;$$

$$a=\frac{(m_1-m_2)g-2M\frac{1}{r}}{m_1+m_2+2I\frac{1}{r^2}};\quad g=\frac{m_1+m_2+2I\frac{1}{r^2}}{m_1-m_2}a+\frac{2M\frac{1}{r}}{m_1-m_2};$$

$$M=\frac{(m_1-m_2)}{2}g-\frac{1}{2}\left(2I\frac{1}{r^2}+m_1+m_2\right)a.$$

Thus, the electronic experiment on the laboratory machine "Atvud machine" allows to simulate the motion with and without friction and tu restore the parameters of the circuit with collective discussion of the features of the process.

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NON-EQUILIBRIUM HEATING WITH LOCAL REDISTRIBUTION OF THERMAL FIELD BY THE MECHANISMS OF INTERFERENCE

The problem of heating large industrial premises with high ceilings can be rationally solved by using so-called nonequilibrium systems, which usually use directed infrared rays, instead of raising the temperature directly of air throughout the volume. In order to create comfortable conditions for the working personnel in large rooms there is no sense to heat the interior area in a traditional way, since warm air as known rising to a higher altitude will not heat volume at once. It lead to an excessive expenditure of energy carriers when heating will be similar to heating for residential premises, where fuel elements are