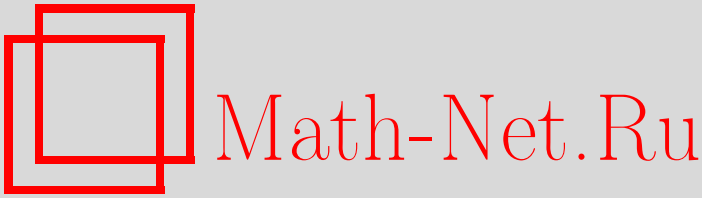

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Литература

1. Ажмухамедов А.И., Копытина Т.А. Особенности мотивационного, институционального и информационного управления персоналом коммерческого банка [Электронный ресурс] // Современные проблемы науки и образования: электрон. научн. журн. 2015. №1. URL: http://www.science-education.ru/pdf/2015/1/110.pdf (дата обращения: 25.01.2016);
2. Кононов Д.А., Кульба В.В., Шубин А.Н. Информационное управление в социально-экономических системах: элементы управления и способы информационного воздействия // Проблемы управления. 2004. №3. С. 25-33;
3. Кульба В.В., Малюгин В.Д., Шубин А.Н. Информационное управление (предпосылки, методы и средства) // Проблемы управления. 2003. №1. С. 62-67;
4. Теория управления / Под ред. А.Л. Гапоненко, А.П. Панкрухина. – М.: РАГС, 2003. – 558 с.

References

1. Azhmuhamedov A.I., Kopytina T.A. Osobennosti motivacionnogo, institucional'nogo i informacionnogo upravlenija personalom kommercheskogo banka [Jelektronnyj resurs] // Sovremennye problemy nauki i obrazovanija: jelektron. nauchn. zhurn. 2015. №1. URL: http://www.science-education.ru/pdf/2015/1/110.pdf (data obrashhenija: 25.01.2016);
2. Kononov D.A., Kul'ba V.V., Shubin A.N. Informacionnoe upravlenie v social'no-jekonomicheskih sistemah: jelementy upravlenija i sposoby informacionnogo vo d ejstvija // Problemy upravlenija. 2004. №3. S. 25-33;
3. Kul'ba V.V., Maljugin V.D., Shubin A.N. Informacionnoe upravlenie (predposylki, metody i sredstva) // Problemy upravlenija. 2003. №1. S. 62-67;
4. Teorija upravlenija / Pod red. A.L. Gaponenko, A.P. Pankruhina. – M.: RAGS, 2003. – 558 s.

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КОНТРОЛЬ МОДЕЛИ И РЕШЕНИЯ ПРАКТИЧЕСКИХ ЗАДАЧ

Аннотация

Важность адекватности выбираемой модели и необходимость исследовательского (нешаблонного) подхода к ее решению продемонстрирована на примере простой задачи.

Ключевые слова: модель, скорость, траектория.

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CONTROL OF MODEL AND SOLUTION OF PRACTICAL PROBLEMS

Abstract

Importance of adequacy to the chosen model and the need of the research (not sample) approach to its decision are shown on the example of a simple problem.

Keywords: model, speed, trajectory.

We will show on the example of a simple problem the importance of research approach to a choice of model and to the search of alternative decisions.

For this purpose it is proposed to consider some various methodically important approaches to the decision of elementary, though rather rare [1] problems of search of the minimal speed allowing in "vacuum" conditions to throw a dot material body through the barrier height of "h" located on horizontal distance of "L" from a position:

a) of "an obvious ipromptu",

b) of decision of system of inequalities,

c) of the physical analysis at the qualitative level.

a) Many even skilled professional physicists believes at once that the top of a parabolic trajectory of a body has to appear precisely over the top point of a barrier.

Then, using entered designations of g - for acceleration of gravity, v - for the initial speed forming a corner α with the horizon and t - for flight time to more top point of a barrier:

$$\begin{Bmatrix} L = v\ t\ cos \propto \\ h \le v\ t\ sin \propto\ -0.5\ gt^2 \\ v\ sin \propto = gt \end{Bmatrix}$$

$$\begin{Bmatrix} t = v\ g^{-1} sin \propto \\ sin2 \propto = 0.5\ L\ g\ v^{-2} \\ v \ge (g(2h + 0.5L^2/h)^{0.5} \end{Bmatrix} \quad (1)$$

About that this decision is inadequate to given problem, it is possible to be convinced, for example, considering limit cases: if at $L \to 0$ we receive the true: $v \to (2gh)^{0/5}$, but at $h \to 0$ is expected $v \to \infty$ that is incorrect.

c) Without doing heuristic assumptions of model (a) we start from two kinematic equations in two orthogonal projections:

$$\begin{Bmatrix} L = v\,t\,cos \propto \\ h \le v\,t\,sin \propto\ -0.5\,gt^2 \end{Bmatrix}$$

then we will exclude time *t* and using parameter: $z \equiv 0.5gL^2v^{-2}$ we will receive a quadratic equation:

$tg(\propto)^2 - \frac{L}{z}\,tg(\propto) + 1 + \frac{h}{z} = 0$

We come from the requirement of nonnegativity of its discriminant to the result:

$$v \ge (g(h + (h^2 + L^2)^{0.5})^{0.5} \quad (2)$$

The sign "plus" before the radical is chosen to obtain the correct limit value

$v \to (2gh)^{0.5}$ if $L \to 0$.

c) Attention is drawn to the simple form (2) of the expression obtained, it is assumed that there may be even more intuitive "semi-quantitative, physical" way to solve. Indeed, in terms of energy problem it is close to the estimation of the required initial velocity of the jumper who is flying to the top of the barrier (coordinates: *L, h*), uses the pole of the length $0.5(h^2 + L^2)^{0.5}$, and relies the middle point between the points of beginning and end of the flight at an height of $0.5h$ (real or fictional, chosen length of the pole has no influence on the result). Then its initial kinetic energy has to be equal to the potential energy of the jumper at the top point of trajectory: $0.5mv^2 = 0.5m(g(h + (h^2 + L^2)^{0.5})$ and leads to an expression (2) for minimal necessary speed too.

Interestingly, that from *tg (2*$\propto$*) =-L/h*, where $\propto$ is angle between initial speed vector and horizontal line, flows: $tg(\propto) = \frac{h+(h^2+L^2)^{0.5}}{L}$, i.e. "aiming" is necessary pithily, located higher than overhead point of barrier on the size of distance from the start point to the top of barrier. Another feature consists in that the tangent of angle β of slope of speed of body on the top of barrier with a vertical line is equal $tg(\beta) = \frac{h+(h^2+L^2)^{0.5}}{L}$, i.e. speed of body in the overhead point of barrier is orthogonal to his initial speed at start point.

In summary we will emphasize that the invalidity of the decision (1) of the first model (item "and") was found at research of its consequences (limit transition to small h) and until other solution (2) for comparison was found, it, generally speaking, couldn't be rejected. Points (“b” and "c") showed invariance of result to various methods of its receiving.

So, on the presented example it is shown that at the decision even of simple physical problem the research approach allows not only to define and expand a scope of the received result, but also to reject decisions which falsehood a priori isn't obvious at all.

References

1. Butikov E.I, Kondratyev A.S. Physics, 2001,M.-SPb., «Physmathlit», page 70 (352p).

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ПРОГРАММА ДЛЯ РАСЧЕТА ПАРАМЕТРОВ «ПУЗЫРЬКА» ПОЗИТРОНИЯ

Аннотация

В настоящее время существует много моделей, описывающих поведение позитрона и позитрония в жидкостях и растворах. Но, в своём большинстве, эти модели, не учитывают то, что параметры «пузырька» зависят от характеристик растворов. А значит получающиеся результаты не могут быть полностью достоверны истинным показателям. Наша программа, написанная по модели, описанной в статье Бучихина [1], учитывает все характеристики растворов и жидкостей, влияющих на изменение параметров «пузырька» и позволяет быстро, и легко рассчитать эти параметры.

Ключевые слова: позитроний, позитронная аннигиляционная спектроскопия с временным разрешением, «пузырьковая» модель.

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THE PROGRAM FOR CALCULATION OF PARAMETERS OF POSITRONIUM "BUBBLE"

Abstract

Currently, there are many models that describe the behavior of the positron and positronium in liquids and solutions. But for the most part, these models do not take into account that the parameters of the "bubble" depend on the characteristics of the solutions. So the results obtained may not be completely reliable indicators of true. Our program was written by the model described in the article Buchihina [1], takes into account all the characteristics of solutions and liquids that affect the change of parameters "bubble" and allows you to quickly and easily calculate these parameters.

Keywords: positronium, positron annihilation spectroscopy with a time resolution, "bubble" model.

Пузырьковая модель была введена Ferrell [2], чтобы оценить увеличение времени жизни pick–off распада ортопозитрония в жидкостях. Этот процесс, посредством которого позитрон в ортопозитронии чувствует электроны с противоположным спином в окрестности, называется двухфотонная аннигиляция. Уменьшение оценки (по сравнению с ожидаемой) было приписано отталкиванию молекул растворенным позитронием через отталкивающее взаимодействие, возникающее от электрона, распределяющееся (обменивающееся) между двумя (Ps