Fizik masalalarni yechishda matematikaning tatbiqi

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Annotatsiya: Ushbu maqolada ba’zi fizikaviy masalalarni yechishda matematikaning tatbiqlari keltirib o‘tilgan. Fizikaviy masalalarni matematik terminlar orqali tafsivlash va matematikani fizik jarayonlarni o‘rganish jarayonlariga qo‘llash orqali ta’lim samaradorligini oshirishga erishish haqida tavsiyalar berib o‘tilgan.

Kalit so‘zlar: formula, koeffitsiyent, tezlik, vaqt, yo‘l, harakat tenglamasi, kvadrat tenglama, masala va yechim

Application of mathematics in solving physical problems

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Abstract: This article cites applications of mathematics in solving some physical problems. Recommendations have been made to improve educational effectiveness by interpreting physical issues through mathematical terms and applying mathematics to processes of study of physical processes.

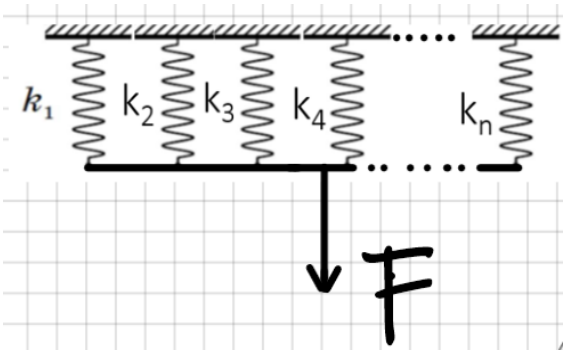
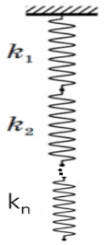
Keywords: formula, coefficient, velocity, time, path, equation of motion, quadratic equation, issue and solution

Ma’lumki, biz fizik masalalarni yechishda matematik usullardan keng foydalanamiz. Matematikadan farqli ravishda, fizikada har bir ishlatgan formulaga ma’no berib ketamiz. Matematikada koeffitsiyent deb qaralgan kattaliklar, fizikada ma’lum bir nomga ega bo‘ladi. Masalan, $y=ax^2+bx+c$ ko‘rinishdagi kvadrat funksiyani olsak, fizikada $S=S_0+v_0t+\frac{at^2}{2}$ esa bu ifoda jismni t vaqt davomida tekis tezlanuvchan harakatda bosib o‘tgan masofasini topish formulasini ifodalaydi. Bunda a, b, c - matematik jihatdan funksiyani harakterlovchi koeffitsiyentlar bo‘lsa, S_0, v_0, a - fizikaviy jihatdan esa bu kattaliklar jismni harakatini harakterlovchi kattaliklar hamdir. Bu yerda: S_0 - jismni boshlang‘ich holatini koordinatasi, v_0 - jismni boshlang‘ich

tezligi, *a* - tezlanish. Matematikadan farqli ravishda o‘zgarmas kattaliklar fizikada jismni holatini harakterlaydi.

Fizikaning har bir bo‘limidagi formulalarni matematik usullar orqali tushuntirish mumkin (ya’ni fizik masalalarni matematik usullar orqali yechamiz). Masalan, kinematikada tekis harakatni $S = v \cdot t$ formula orqali beramiz, matematik tilda esa buni t – vaqtga nisbatan chiziqli funksiya hossalari orqali tushuntiirsak bo‘ladi. Yana o‘zgaruvchan harakatni ham shu usulda tushuntirsak bo‘ladi, ya’ni o‘zgaruvchan harakatni fizikada $S = S_0 + v_0 \cdot t + \frac{at^2}{2}$ formula yordamida tasvirlasak, matematik usullar orqali tushuntiradigan bo‘lsak bu kvadrat funksiya xossalari bilan uyg‘unlashadi.

Fizik masalalarni hisoblashda matematik usullar bilan ishlash birmuncha qulay bo‘ladi. Masalan, fizikaning dinamika bo‘limida prujinalarni ketma-ket va parallel ulashda matematik usullar bilan odatdagidan osonroq hisoblashimiz mumkin. Prujinalarni ulashda asosan fizikada arifmetik va geometrik progressiyalarga bo‘ysinuvchi prujinalar olinadi.

$\Delta x_{um} = \Delta x_1 = \Delta x_2 = \cdots = \Delta x_n$ $F_1+F_2+...+F_n=F_{um}$ $k_1\,\Delta x_1 + k_2\,\Delta x_2 + ... + k_n\,\Delta x_n = k_{um}$ $k_1+k_2+...+k_n=k_{um}$ $\sum_{i=1}^{n} k_i$ $k_1=k_0$ $k_n=k_{n-1}+d$ $\sum_{i=1}^{n} k_i=\frac{k_1+k_n}{2}*n$ 	$\Delta x_{um} = \Delta x_1 + \Delta x_2 + \cdots + \Delta x_n$ $F_1=F_2=...=F_n$ $F=k*\Delta x$ $\Delta x = \frac{F}{k}$ $\frac{F_{um}}{k_{um}} = \frac{F_1}{k_1} + \frac{F_2}{k_2} + \cdots + \frac{F_n}{k_n}$ $\frac{1}{k_{um}} = \frac{1}{k_1} + \frac{1}{k_2} + \cdots + \frac{1}{k_n}$ $\sum_{1}^{n} \frac{1}{k_i}\, k_1 = k_0\, k_n = k_{n-1} * a$ $\sum_{i=1}^{n} \frac{1}{k_i} = \frac{k_0(1-a^n)^n}{1-a}$ 

Ba’zi fizik masalalar (deformatsiya, bosim, energiya minimallashuvi kabi) ikki o‘zgaruvchili funksiyaning ekstremumini topish orqali yechilishi mumkin. Shu sababli, fizikada ham optimallik shartlarini aniqlash uchun ekstremumlarni tekshirish muhim. Buni quyida bitta masala orqali tushuntirib o‘tamiz:

1-masala: Issiqlik manbai bilan qizitilayotgan metall plastinkaning harorat taqsimoti *T(x,y)* formulasi bilan berilgan: $T = 100 - 4x^2 - 9y^2$ (*x* va *y* – plastinkaning

yuzasidagi koordinatalar (*m*), *T(x,y)* – shu nuqtadagi harorat, *°C*). Plastinkaning qaysi nuqtasida harorat maksimal bo‘ladi?

➢ Birinchi tartibli hosilalarni nolga tenglashtiramiz:

$$\frac{\partial T}{\partial x} = -8x \; \frac{\partial T}{\partial y} = -18y$$

Ekstremum nuqtalarini topish uchun har ikkisini nolga tenglashtiramiz:

-8x=0 x=0; -18y=0 y=0

Demak, ekstremum nuqtasi *(0;0)* da joylashgan.

➢ Ikkinchi tartibli hosilalar bilan ekstremumni tekshiramiz:

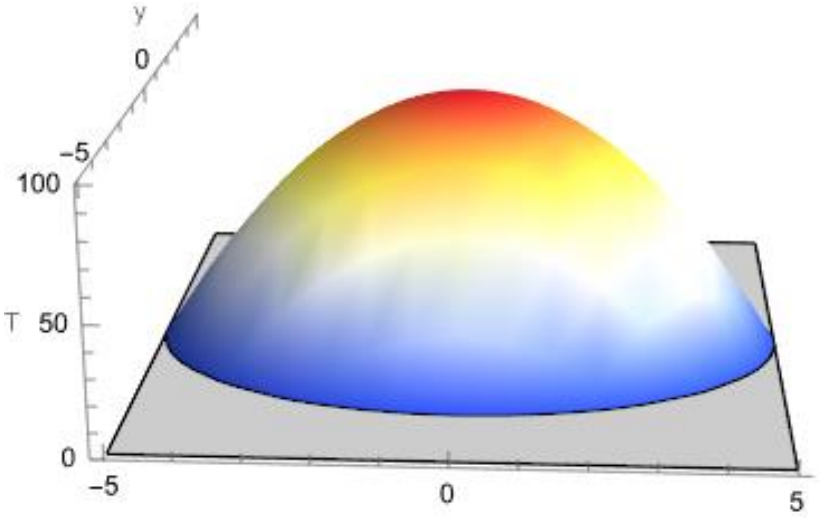
$$\frac{\partial^2 T}{\partial x^2} = -8 \; \frac{\partial^2 T}{\partial y^2} = -18 \; \frac{\partial^2 T}{\partial x \partial y} = 0$$

Diterminatni hisoblaymiz: $D=(-8)(-18)-0^2>0$, $a_{11}<0$

$D>0$ va ikkinchi tartibli hosila manfiy, demak bu nuqtada maksimal harorat mavjud.

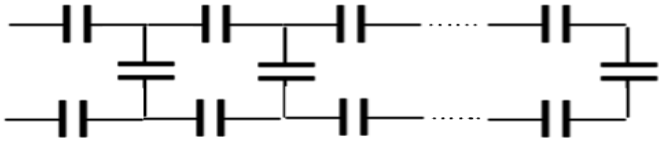
Plastinkaning (0;0) nuqtasida harorat maksimal bo‘ladi va uning qiymati:

$$T(0;0)=100-4*0^2-9*0^2=100℃$$



1-rasm. Masala shartiga mos shakl.

Fizik masalalarni yechishda doimo mantiqiy fikrlash lozim. Agar biz masalani tub mohiyatini anglab yetmasak, uni to‘g‘ri yecha olmaymiz. Masalan, elektr bo‘limidan bir masalani olsak: Elektr sig‘imlari bir xil bo‘lgan, aralash ulangan va cheksiz kondensatorlar to‘plamining umumiy sig‘imini hisoblang?



2-rasm. Masala shartiga mos shakl.

Masalani mantiqiy fikr yuritib yechadigan bo‘lsak, quyidagi kabi ko‘rinishga keladi. Natijada C ga oid kvadrat tenglama hosil bo‘ladi. Buni matematik usullar yordamida oddiy diskriminant orqali oddiygina yechish mumkin.

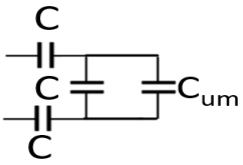
$$\frac{1}{C_{um}} = \frac{2}{C} + \frac{1}{C_{um} + C}$$

$$\frac{3C + 2C_{um}}{C(C + C_{um})} = \frac{1}{C_{um}}$$

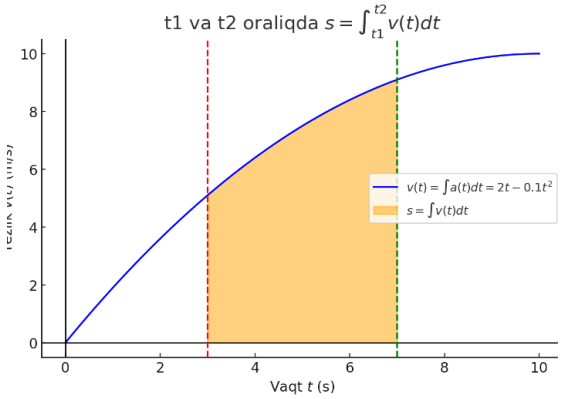
$$3 * C * C_{um} + 2 * C_{um}^2 = C^2 + C * C_{um}$$

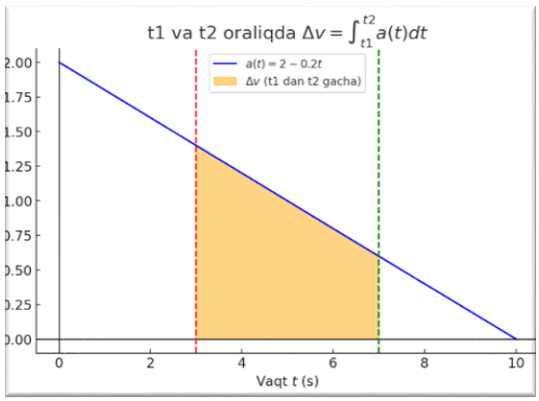
$$2 * C_{um}^2 + 2 * C * C_{um} - C^2 = 0$$

$$C_{um} = \frac{\sqrt{3}-1}{2} C$$



Biz matematikada hosila yordamida funksiyaning ekstrimumlarini tekshiramiz, integrallash orqali *F(x)* boshlang‘ich funksiyani [a;b] oraliqda hosil qilgan yuzasini topishimiz mumkin. Bu holat fizikada sal boshqacharoq ma’noni anglatadi. Masalan, harakat tenglamasidan vaqt bo‘yicha 1-tartibli hosila oniy tezlikni hosil qiladi, *a(t)* fuksiyani [t_1;t_2] oraliqdagi integrali tezlikni o‘zgarishini ifodalaydi.





3-rasm. Masala shartiga mos shakl.

Xulosa. Xulosa o‘rnida shuni ayta olamizki, fizika fanini teran tushunib olishimiz uchun matematikaning roli juda muhim ekan. Matematikani bilmasdan fizika fanini tub mohiyatini anglab yeta olmaymiz.

Foydalanilgan adabiyotlar

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