“Toshkent irrigasiya va meliorasiya instituti

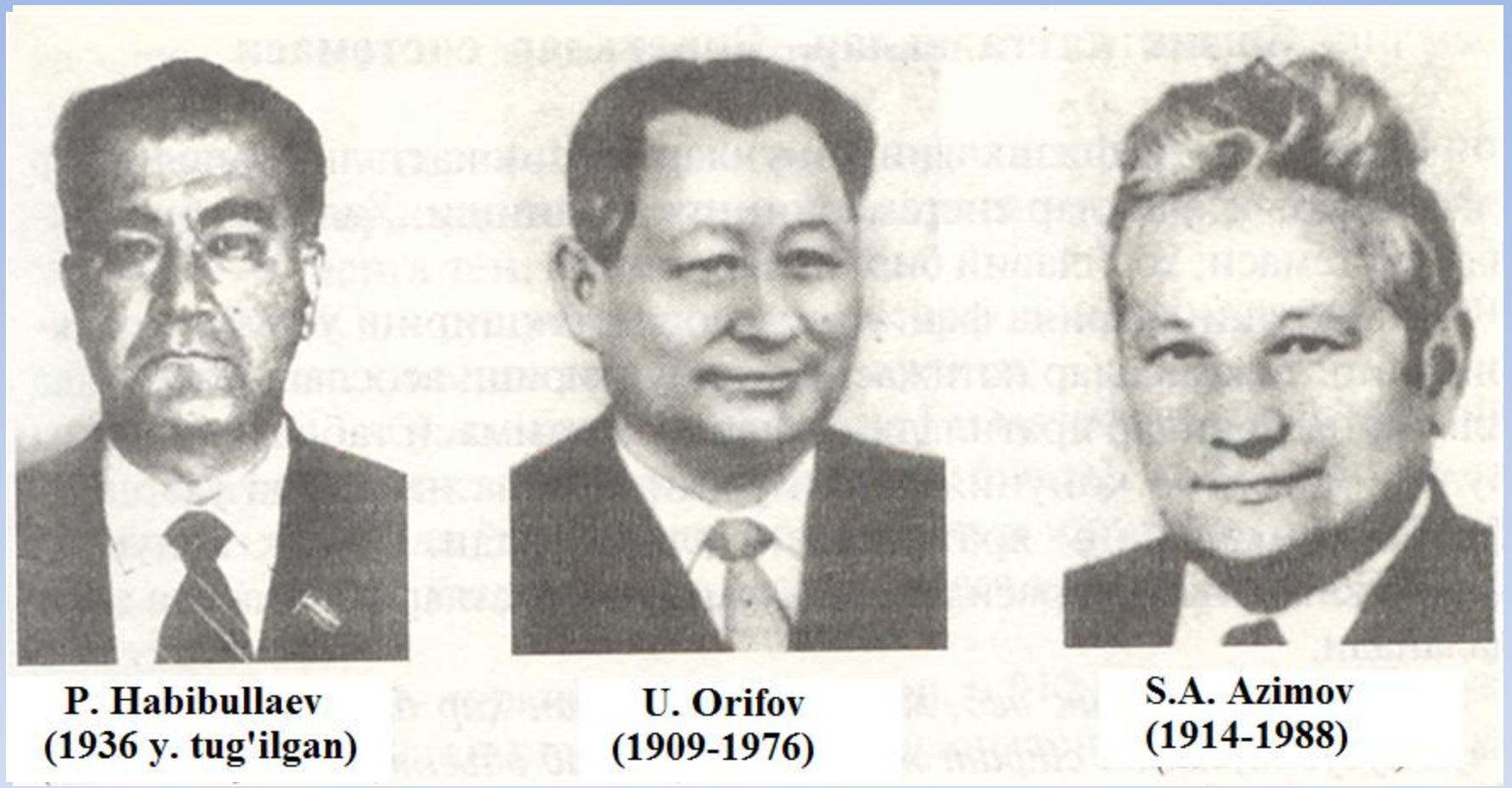
Fizika va kimyo kaferdasi

KIRISH

Fizika *fanin*ing mazmuni.
Fizikaning boshqa fanlar bilan aloqasi.

Fizika tabiat xakidagi fanlardan biri bulib, u atrofimizdagi nixoyatda ulkan va murakkab olamning eng umumiy xossalarini, uning eng umumiy xarakati turlarini, bu xarakatlarni tavsiflovchi konunlarni xamda xodisalar orasidagi munosabatlarni urganadi.

Bizni urab olgan dunyo moddiydir, u doimo mavjud bulgan va uzluksiz xarakatlanuvchan materiya kurinishidadir. Materiya tabiatda real mavjud bulgan barcha narsalardir. Materiyaning konkret turi xilma - xildir. Ularga elektronlar, protonlar, neytronlar, α - zarrachalar, atomlar, molekulalar va boshka kurinishidagi elementar zarralar, bunday zarralarning kuplab majmuasi bulgan *fizik jismlar va fizik maydonlar* kiradi.



P. Habibullaev
(1936 y. tug'ilgan)

U. Orifov
(1909-1976)

S.A. Azimov
(1914-1988)

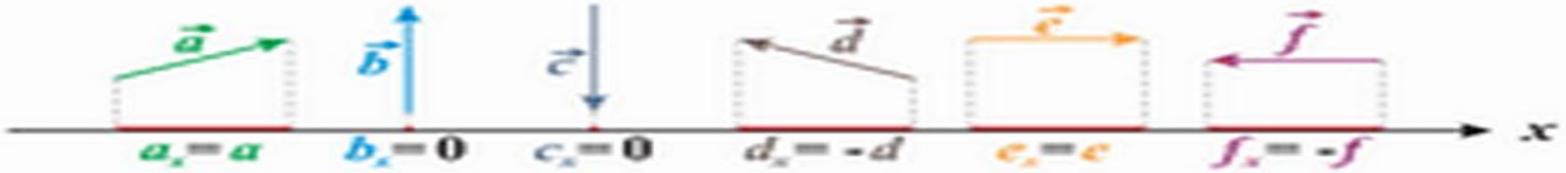
Fizikaning boshka fanlar bilan alokasi.

Fizika barcha tabiiyot fanlarining va amaliy fanlarning muvoffakiyatli rivojlanishi uchun zarur bulgan tadkikot usullarini ishlab chikishga va asboblar yaratishga imkon beradi. Masalan, mikroskopni biologiyadagi, teleskopni astronomiyadagi, spektral analizni kimyodagi, rentgen analizni meditsinadagi va x.k. axamiyati goyat kattadir. Xozirgi paytda barcha tabiiy va amaliy fanlarning aloxida fizika bulimlari bor: astronomiyada - astrofizika, biologiyada - biofizika, agronomiyada - agrofizika, elektrotexnikada-elektrofizika va x.k. SHularga asoslanib, fizika barcha tabiiy va amaliy fanlarning yaratilishi uchun poydevordir deyish mumkin.

МЕХАНИКА

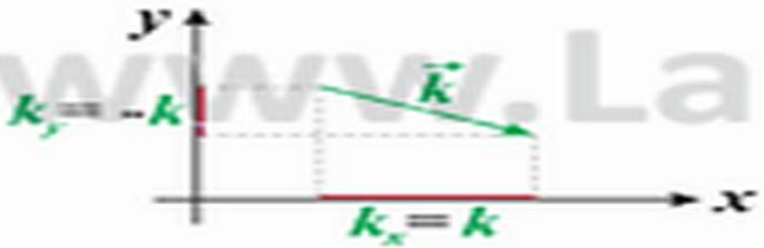
Проекция вектора

Одномерный случай

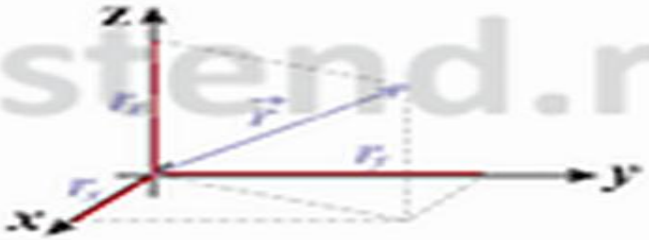


Проекция положительна, если от проекции начала вектора к проекции конца нужно идти по направлению оси

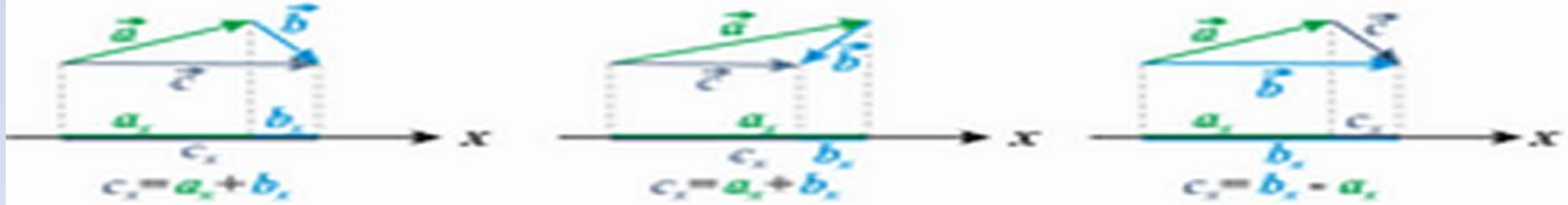
Двумерный случай



Трехмерный случай



Проекция суммы (разности) векторов



Проекция суммы (разности) векторов равна сумме (разности) проекций векторов на эту же ось

МЕХАНИКА

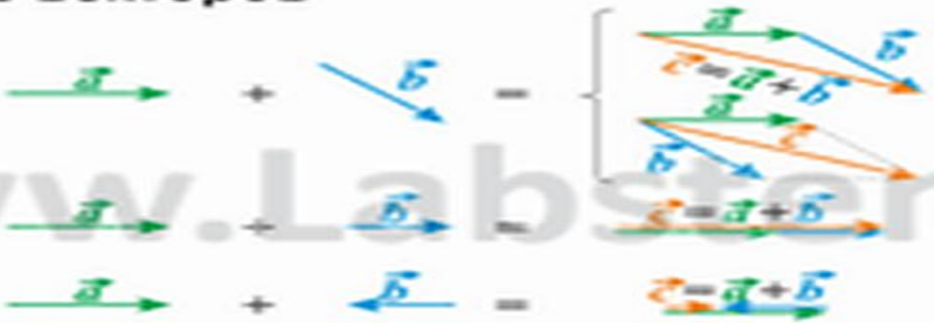
Действие над векторами

Вектор — величина, задаваемая численным значением и направлением

$\vec{S}$ - вектор

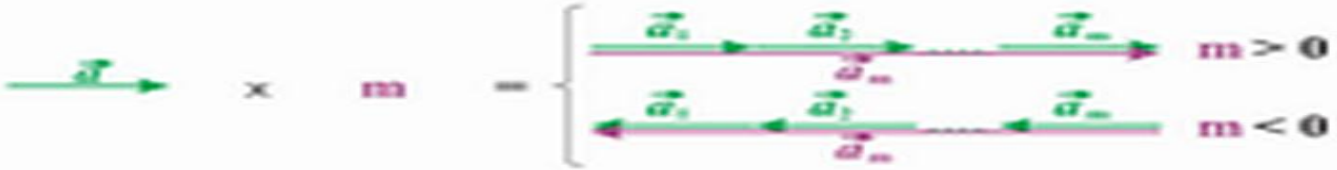
S - модуль вектора (длина вектора)

Сложение векторов



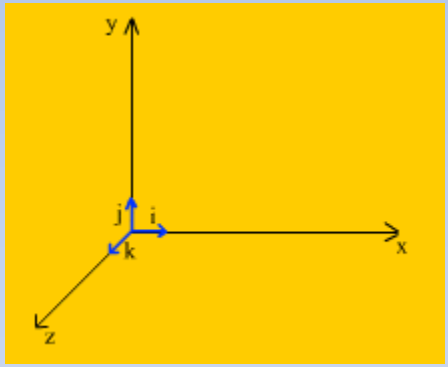
Вычитание векторов

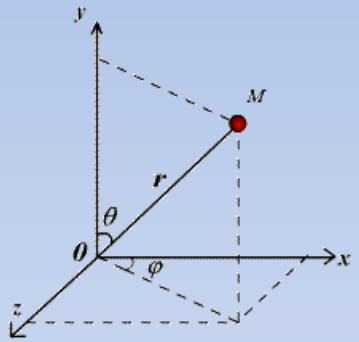
Умножение вектора на скаляр



• Sanok tizimi.

- Fazoviy sanok tizimi sifatida nisbiy tinchlikda yoki tugri chizikli tekis xarakat kilayotgan jismni olib uni koordinata uklari bilan boglash mumkin. Masalan, uchta bir - biriga tik kattik sterjenlar kurinishidagi tugri burchakli Dekart koordinatalar tizimi. Bunday sanok tizimida tanlab olingan jism urnini uchta son: x, u, z, koordinatalari orkali belgilanadi.





- Bundan tashkari kutb, tsilindrik koordinatalar sistemasidan xam foydalanish mumkin.
  Masalan: kutb koordinatalar sistemasida MN ning radius vektorini r, yunalishini θ, ϕ burchaklar bilan ifodalanadi. Jismni vaziyatini ifodalovchi r, θ, ϕ lar kutb koordinatalari sistemasi deyiladi. Bu sistemadan Dekart koordinatasi sistemasiga utish kuyidagicha buladi.
- z = r sinθ • cosϕ x = r sinθ • sinϕ y = r cosθ
  Dekart koordinata sistemasida kutb koordinata sistemasiga utish kuyidagicha.

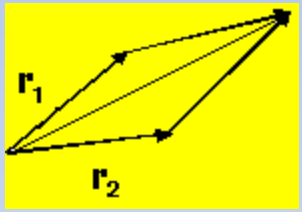
$$r=\sqrt{x^2+y^2+z^2} \qquad \cos\theta=\frac{y}{\sqrt{x^2+y^2+z^2}} \qquad ва \qquad tg\,\varphi=\frac{z}{x}$$

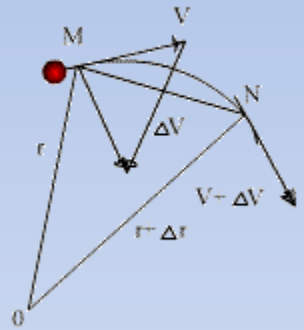
Moddiy nuqtaning ilgarilanma harakati kinematikasi

Traektoriyada bir-biriga yakin joylashgan ikki vaziyatni birlashtiruvchi va xarakat yunalishini kursatuvchi kesma kuchish deyiladi.

Vakt intervali juda kichik bulganda yoki xarakat tugri chizikli bulganda S = r buladi.

Agar moddiy nukta bir vaktni uzida ikkita kuchishda ishtirok etayotgan bulsa uning oxirgi vaziyati ikkala kuchish baravariga amalga oshganiga boglik emas. Xarakat okibati bir xil bulib, natijali kuchish vektori parallelogram koidasi bilan topiladi.





Xarakatlanayotgan jismning radius-vektori r = r (t) ni uzgarishi vaktga boglik ravishda kanchalik jadalligini baxolash zarur buladi. SHu maksadda xarakat tezligi tushunchasi kiritiladi.

Faraz kilaylik, umumiy xolda egri chizikli xarakat kilayotgan va t paytda M nuktada bulgan MN Δt vakt ichida N nuktaga kelsin. M va N nuktalarning radius- vektorlari mos xolda r va r + Δr va MN yoyning uzunligi Δs bulsin. MN kuchishi ya’ni radius - vektor ortirmasi Δr ning shu kuchish uchun sarflangan vakt Δt ga nisbati MN ning urtacha tezligi deb ataladi.

Δt vakt oraligi cheksiz kichiklashtirib borilsa urtacha tezlik intiladigan limit oniy tezlik buladi.

Modiy nuqtaning egri chiziqli harakati

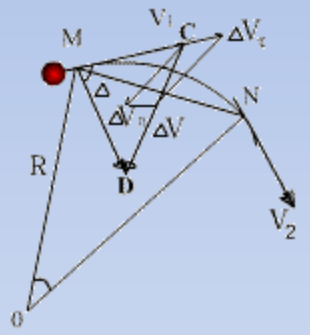
-
- Egri chizikli xarakat xakida tushuncha.
- Egri chizikli xarakatda tezlanish.
- Markazga intilma tezlanish.
- Aylana buylab xarakat.
- Burchakli tezlik va burchakli tezlanish.
-

- Aytaylik, MN MN egri chiziklik xarakatda bulsin. Bunday xarakatda tezlik vektorini oniy kiymati va yunalishi vakt buyicha uzgarib turadi. M va N nuktalardagi tezlik vektorlari $\mathbf{V_1}$ va $\mathbf{V_2}$ bulsin. Ularni ayirmasi

  $\mathbf{\Delta v = v_2 - v_1}$ ga teng.

  Bu vektorni ikkita $\mathbf{\Delta V_n}$ va $\mathbf{\Delta V_\tau}$ tashkil etuvchilarga ajratamiz. $\mathbf{\Delta V_\tau}$ tashkil etuvchi oniy tezlikni mikdoriy uzgarishini baxolaydi va u M nuktaga urinma ravishda yunalgan buladi. $\mathbf{\Delta V_n}$ tezlik ortirmasi oniy tezlikni yunalishi buyicha uzgarishini kursatadi va u egrilik markaziga karab yunalgan buladi.

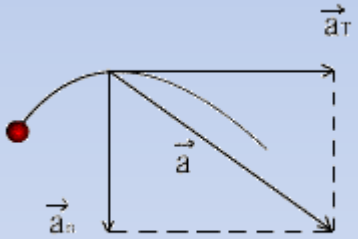
$\mathbf{\Delta V = \Delta V_\tau + \Delta V_n}$ **(1)**



$$\lim_{\Delta t\to 0}\frac{\Delta\vec{V}}{\Delta t}=\lim\frac{\Delta\vec{V}_\tau}{\Delta t}+\lim_{\Delta t\to 0}\frac{\Delta V_n}{\Delta t}\quad \text{ёки}\quad \frac{dV}{dt}=\frac{dV_\tau}{dt}+\frac{dV_n}{dt}\qquad (2)$$

$$\vec{a}=\frac{d\vec{V}}{dt}=\frac{d\vec{V}_\tau}{dt}+\frac{d\vec{V}_n}{dt}=\vec{a}_\tau+a_n\qquad (3)$$

- Demak, egri chizikli xarakatni berilgan nuktasidagi tezlanish vektorining oniy kiymati uning urinma va normal tashkil etuvchilari yigindisiga teng ekan. a_τ - urinma tezlanish vakt birligi ichida oniy tezlikning mikdoriy uzgarishini kursatadi va u $a_\tau = dV / dt$ ga teng buladi.
- SHaklda ΔMDC va Δ MON uxshash uchburchaklar xosil bulgan.
  Δt → 0 intilganda MN vatarni uzunligi ΔS yoyga M nukta egriligi N nukta egriligiga , $v_2 \rightarrow v_1$ ga, tezlikni Δv_n orttirmasi dv_n ga intiladi. Uchburchaklarning uxshashligidan
- Normal tezlanish kuyidagicha buladi.
- a_τ va a_n lar uzaro tik yunalgan, shu sababli MN tezlanishining son kiymati



$$a_n = \lim_{\Delta t \to 0} \frac{\Delta V_n}{\Delta t} = \frac{V}{R} \cdot \lim_{\Delta t \to 0} \frac{\Delta S}{\Delta t} = \frac{V^2}{R}$$

$$a = |\vec{a}| = \sqrt{a_\tau^2 + a_n^2} = \sqrt{\left(\frac{dV}{dt}\right)^2 + \left(\frac{V^2}{R}\right)^2}$$

- Tugri chizikli xarakatda a_n=0 bulib, a=a_t buladi. Xarakatni oz bulsada egrilanishi a_n ni yuzaga kelishi bilan xarakterlanadi va bu normal tezlanishni yunalishi traektoriyani botik tomoniga karagan buladi.

  Traektoriyani egrilik darajasi kuyidagicha buladi

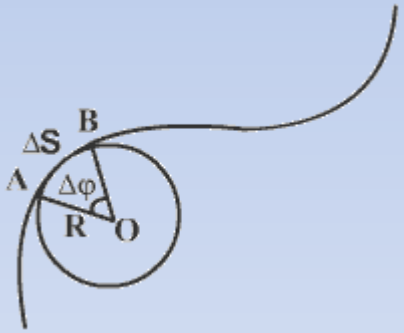
-

  Bu yerda Δϕ - ΔS = AV masofada turuvchi urinmalar orasidagi burchak AOV ga teng. S ga teskari bulgan

- ifoda egrilik radiusi deyiladi.

  Bu kattalik ixtiyoriy egri chizikning kichik yoyi bilan ustma-ust tushuvchi aylanani radiusiga teng buladi. Aylanani markazi egrilik markazi deb xam yuritildai.

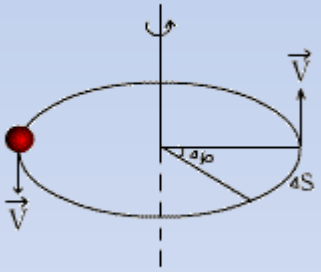
-



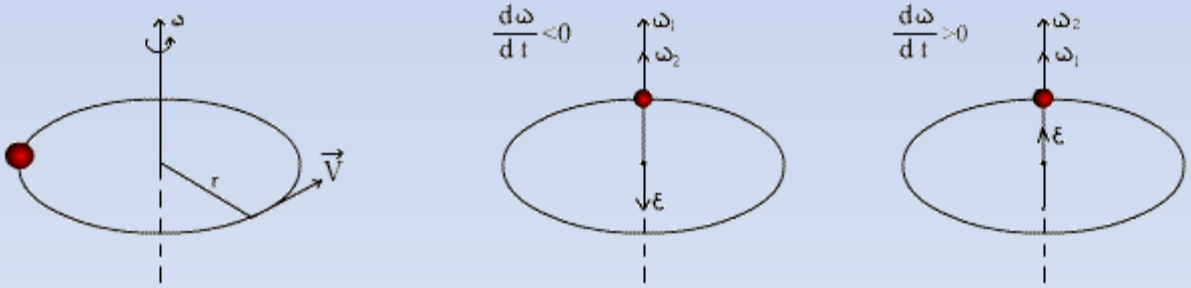
$$C = \lim_{\Delta S \to 0} \frac{\Delta \varphi}{\Delta S} = \frac{d\varphi}{dS} \qquad (1)$$

$$R = \frac{1}{c} = \frac{dS}{d\varphi} \qquad (2)$$

- <u>Egri chizikli xarakatni sodda xoli aylana buylab tekis xarakatdir.</u> Uning shartlari $a_\tau = 0$ $a_n = V^2 / r = const$
- Aytaylik, MN r radiusli aylana buylab xarakatlansin. Juda kichik vakt ichida uni burilish xolatini Δϕ burchak bilan belgilaylik (Δϕ ≈ S/r)
  Burilish burchagi Δϕ dan vakt buyicha olingan xosila
- burchakli tezlik deyiladi. Burchakli tezlik vektorini yunalishi vint koidasidan chikadi. **ω ni yunalishi parma vint uchining ilgarilanma xarakati yunalishi bilan bir xil bulib, uning dastagini yunalishi MN aylana buylab xarakatiga mos keladi va rad/s larda ulchanadi**



$$\vec{\omega} = \lim_{\Delta t \to 0} \frac{\Delta \varphi}{\Delta t} = \frac{d\vec{\varphi}}{dt}$$

- Nuktaning chizikli tezligi
- Demak V = ω • r (3)
  Agar ω = const bulsa aylanish tekis bulib, MN bir T davr ichida tulik bir aylanada va 2π rad burchakka buriladi, ya'ni Δϕ = 2π, Δ t =T.
  SHuning uchun ω = 2π / T yoki T = 2π /ω (4)buladi.
  Bundan ν = 1 / T = ω / 2π (5) kattalik chastota deyiladi. Birligi 1/s=Gts.
  Bundan ω = 2π • ν yoki ν = 2π νR.
  <u>Agar MN aylana buylab notekis xarakat kilayotgan bulsa burchakli tezlanish tushunchasi kiritiladi.</u>
- <u>Burchakli tezlanish vektori aylanish uki buyicha burchakli tezlikni elementar usishi vektori tomonga yunalgandir.</u>
  Tezlanuvchan xarakatda ε va ω lar parallel , sekinlanuvchan xarakatda ε va ω lar anti paralleldir.
- 

$$V = \lim_{\Delta t \to 0} \frac{\Delta S}{\Delta t} = \lim_{\Delta t \to 0} \frac{r \cdot \Delta \varphi}{\Delta t} = r \lim_{\Delta t \to 0} \frac{\Delta \varphi}{\Delta t} = \omega \cdot r$$

- **Tayanch iboralar:**

- Egri chizikli xarakat,
- urinma tezlanish,
- normal tezlanish,
- burchakli tezlik,
- chastota,
- burchakli tezlanish

Mavzu:

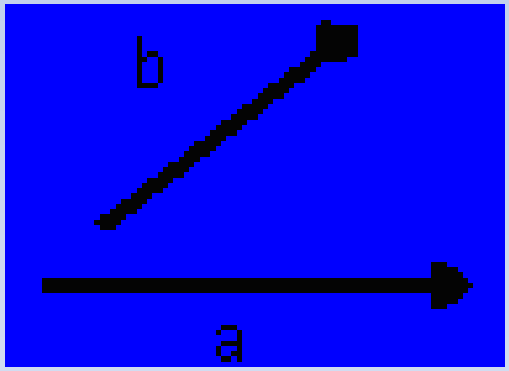
Ilgarilama xarakat KINEMATIKASI

Reja:

- 1. Vektor kattaliklar.
- 2. Tezlik. O’rtacha va oniy tezliklar
- 3. Tezlanish
- 4. To’g’ri chiziqli tekis harakat va uning harakat tenglamasi.
- 5. Tezlik va yo’l grafiklari.jismlarning erkin tushishi;
- 6. Yuqoriga tik otilgan jismning harakati;
- 7. Egri chiziqli tekis xarakat. Ayalana bo’ylab tekis harakat.
- 8. Chiziqli tezlik bilan burchak tezlik orasidagi bog’lanish

Vektor kattaliklar.

- *Son qiymati va yo’nalishini ifodalaydigan kattalik vektor kattalik deyiladi.*



Vektorlarni qo’shish. Ikkta a va b vektorlar yig’indisi deb, tomonlari shu vektorlardan iborat bo’lgan parallelogramning diaganaliga teng bo’lgan vektorlarga aytiladi.
c = a + b.

Tezlik

- *Vaqt birligi ichida jismning o'tgan masofasining son qiymatiga teng bo'lganfizik kattalik tezlik deyiladi*

Δs masofaning Δt vaqt oralig'iga bo'lgan nisbati bilan o'lchanadigan fizik kattalik moddiy nuqtaning $v_{o'r}$ o'rtacha tezligi deyiladi:

$$v_{o'r} = \frac{\Delta s}{\Delta t}.$$

Oniy tezlik

$$v = \lim_{\Delta t \to 0} v_{o'r} = \lim_{\Delta t \to 0} \frac{\Delta s}{\Delta t} = \frac{ds}{dt}$$

$$\vec{v} = \lim_{\Delta t \to 0} \vec{v}_{o'r} = \lim_{\Delta t \to 0} \frac{\Delta \vec{s}}{\Delta t} = \frac{d\vec{s}}{dt}$$

$$[v] = \frac{[\Delta s]}{[\Delta t]} = \frac{1\text{m}}{1\text{s}} = 1\frac{\text{m}}{\text{s}}.$$

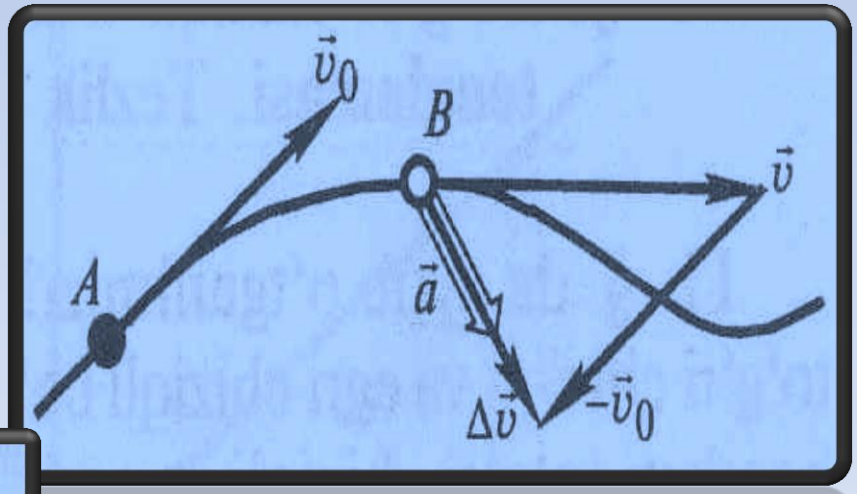
- *Trayektoriyaning ixtiyoriy nuqtasida harakatning oniy tezligi trayektoriyaga o'tkazilgan urinma bo'ylab yo'nalgan, kattaligi jihatidan esa s yo'ldan t vaqt bo'yicha olingan hosilaga teng bo'lgan vektor kattalikdir.*

$$1\frac{\text{sm}}{\text{s}} = \frac{10^{-2}\,\text{m}}{\text{s}} = 1 \cdot 10^{-2}\,\frac{\text{m}}{\text{s}}, \quad 1\frac{\text{km}}{\text{soat}} = \frac{10^{3}\,\text{m}}{3600\text{s}} = \frac{10}{36}\,\frac{\text{m}}{\text{s}}$$

Tezlanish

- *Vaqt birligi ichida tezlik vektori o'zgarishining son qiymatiga teng bo'lgan fizik kattalik* ***tezlanish*** *deyiladi.*

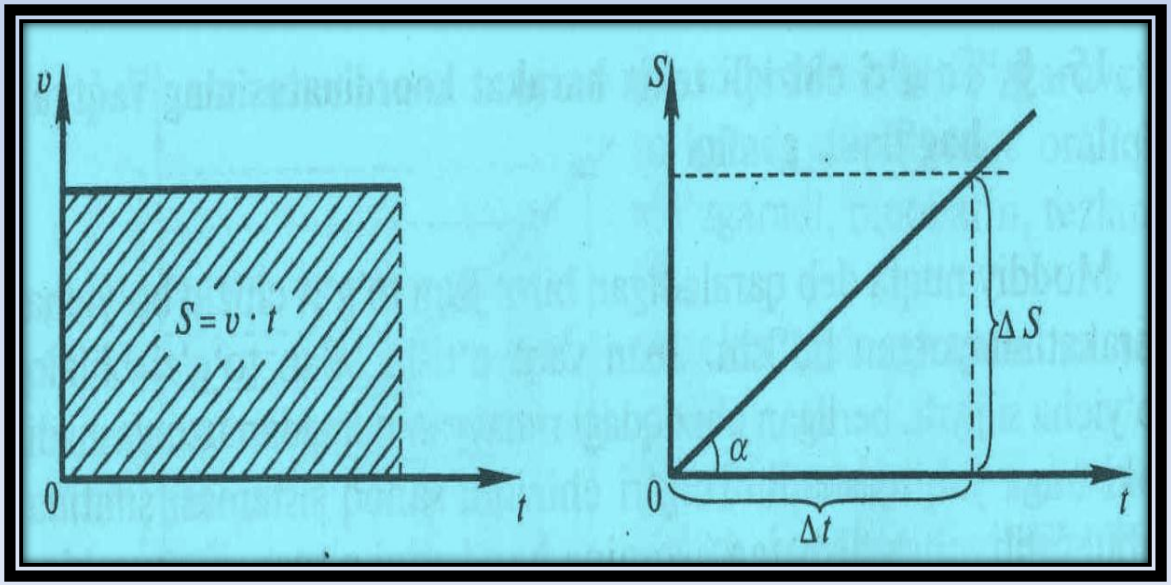
$$\vec{a}_{o'r} = \frac{\vec{v} - \vec{v}_0}{\Delta t} = \frac{\Delta \vec{v}}{\Delta t}.$$



$$\vec{a} = \lim_{\Delta t \to 0} \vec{a}_{o'r} = \lim_{\Delta t \to 0} \frac{\Delta \vec{v}}{\Delta t} = \frac{d\vec{v}}{dt}.$$

To'g'ri chiziqli tekis harakat va uning harakat tenglamasi

- *Agar jism to'g'ri chiziqli harakatida teng vaqt oraliqlarida teng masofalarni bosib o'tsa, jismning bunday harakati to'g'ri chiziqli tekis harakat deyiladi*

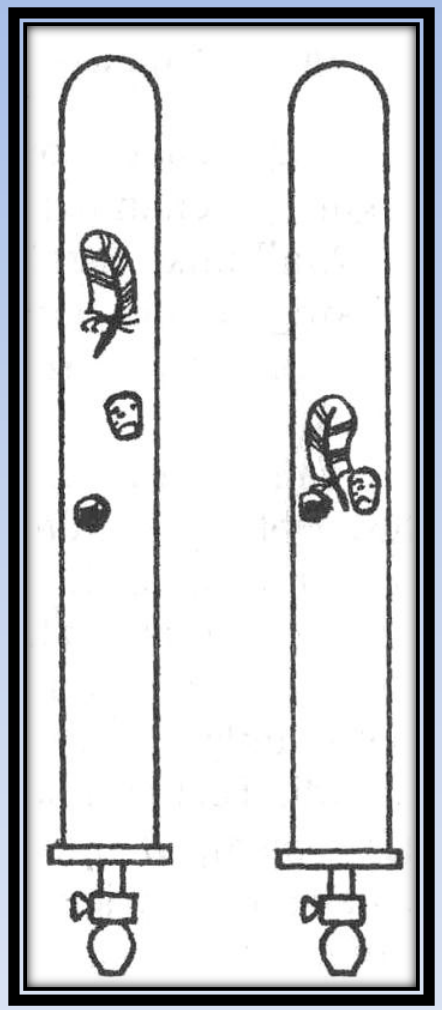


$$v = \frac{s}{t} \quad \text{yoki} \quad \vec{v} = \frac{\vec{s}}{t}$$

$$v = \operatorname{tg}\alpha = \frac{\Delta s}{\Delta t}.$$

Jismlarning erkin tushishi

- *Vakuumda jismlarning faqat og'irlik kuchi ta'sirida Yerga tushishi erkin tushish* deyiladi.



Jismlarning erkin tushishi boshlang'ich tezliksiz to’g'ri chiziqli tekis tezlanuvchan harakatdir.

Yerning muayyan joyida, barcha jismlar bir xil tezlanish bilan tushadi. Bu tezlanish *erkin tushish tezlanishi* deb ataladi va *g* harfi bilan belgilanadi.

Yerning turli nuqtalarida erkin tushish tezlanishi turli qiymatlarga ega bo'ladi. U ekvatorda 9,780, qutbda esa 9,832 m/s^2 ga teng. g=9,80665 m/s^2 bo'lgan erkin tushish tezlanishining qiymati *normal qiymat* deb hisoblanadi.

$$g = 9{,}8\frac{\text{m}}{s^2} = 980\frac{\text{sm}}{s^2}$$

$$v = gt,$$

$$h = \frac{gt^2}{2}, \quad h = \frac{v^2}{2g}$$

$$v = \sqrt{2gh}.$$

- Jismning ma'lum balandlikdan tushishiga ketadigan vaqtni, tushayotgan jismning istalgan nuqtadagi va istalgan paytdagi tezligini va boshqa kattaliklami yuqorida keltirilgan formulalardan foydalanib hisoblab topish mumkin.

Yuqoriga tik otilgan jismning harakati

Jismni yuqoriga tik otishda trayek-toriyaning ixtiyoriynuqtasida ko'tarilish va tushish tezliklari teng bo'ladi , ya'ni jism qanday tezlik bilan yuqoriga tik otilgan bo'lsa, shunday tezlik bilan otilishjoyiga qaytib tushadi.

$$v = v_0 - gt.$$

$$h = v_0 t - \frac{1}{2} g t^2,$$

$$h = \frac{v_0^2 - v^2}{2g}.$$

$$h_{max} = v_0 \frac{v_0}{g} - \frac{g}{2} \frac{v_0^2}{g^2} = \frac{v_0^2}{2g}$$

$$h_{max} = \frac{v^2}{2g}$$