

Ma'ruza №13

MEXANIZMLARNING KINEMATIK TAHLILI. MEXANIZM ZVENOLARINING CHIZIQI TEZLIK VA TEZLANISHLARINI ANIQLASH

➤ Reja:

- Kinematikani o`rganish usullari.
- Mexanizmlarni turli xolatlardagi planlarini chizish
- Tekis mexanizm bo`g`in nuqtalarining tezlik va tezlanishlarini topish

Kinematik analiz usullari

Analitik usul

Yopiq vektorli konturlar usuli

To'g'ri burchakli koordinatalar usuli

Trigonometrik usul

Grafik usul

Tezliklar plani

Tezlanishlar plani

Grafoanalitik usul

O'lchash usuli

Diagrammalar qurish

Tekislikda bo'g'inlarning harakat turlari

ilgarilanma

Sirpanuvchi
(polzun),
turtkich

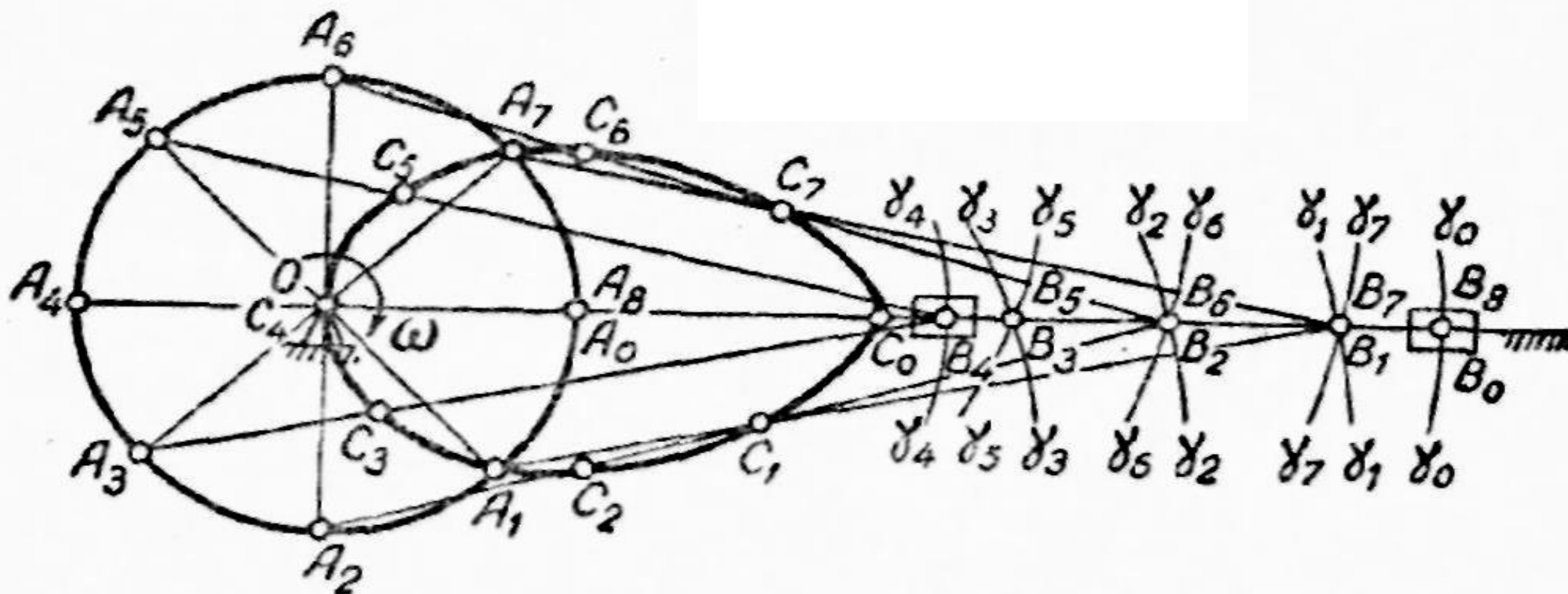
aylanma

Krivoship,
koromislo,
kulisa

Tekis
parallel-
murakkab

Shatun, tosh

MEXANIZMLARNING TURLI XOLATLARDAGI PLANLARINI TUZISH

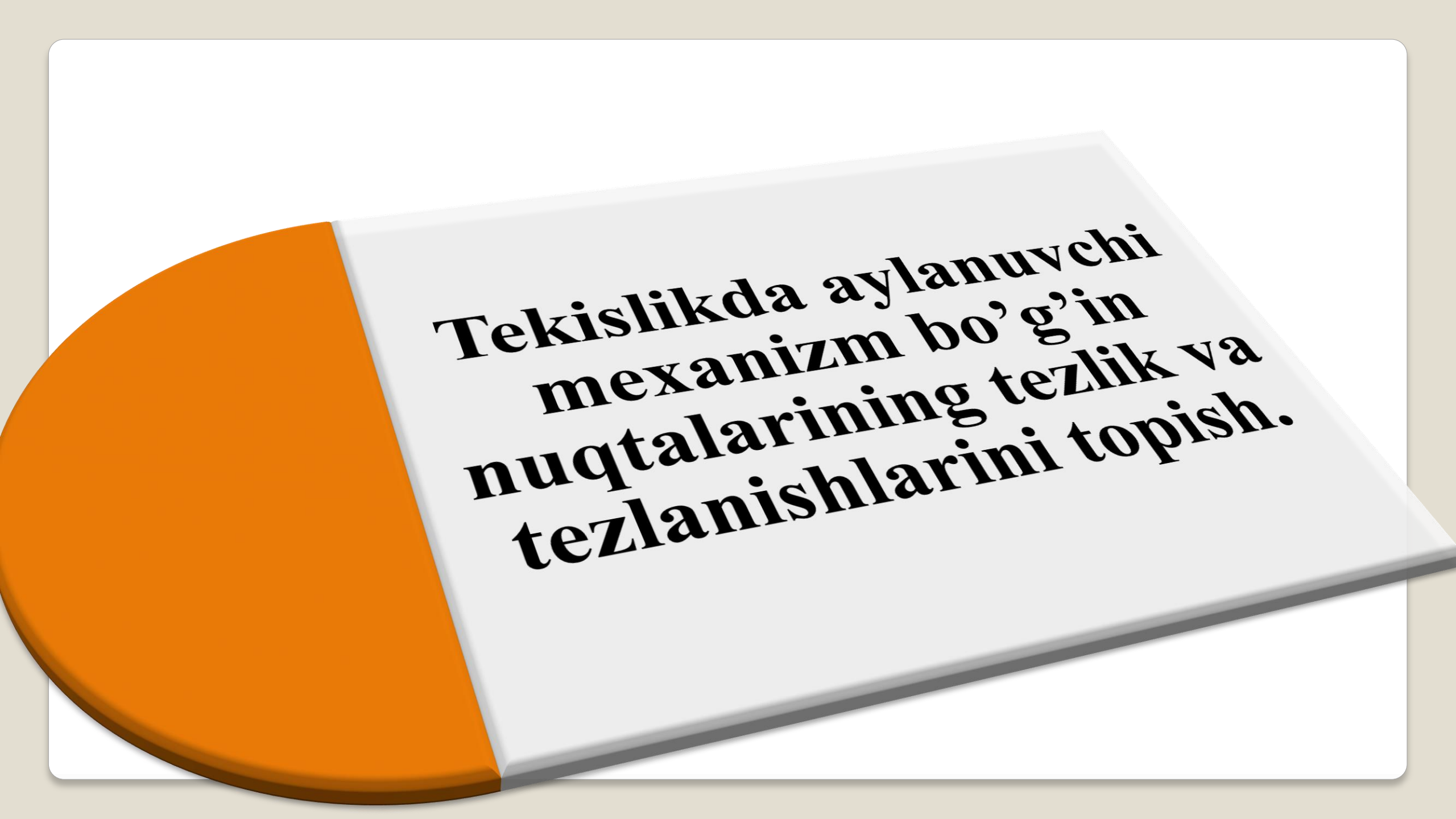



$$\mu_e$$

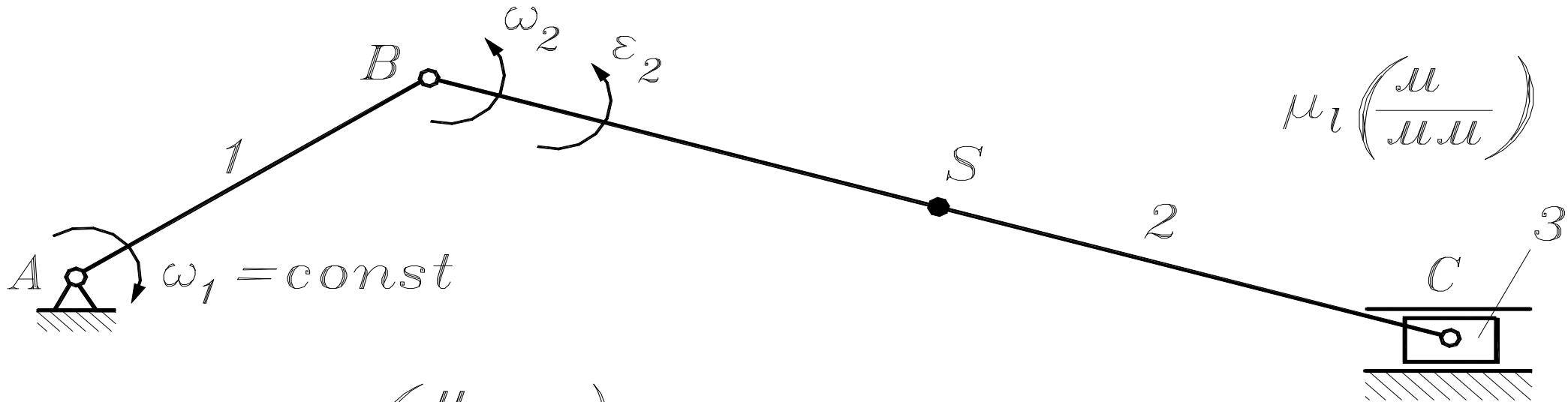
Mexanizmlarning kinematik sxemasini chizish uchun uzunlik masshtabi tanlab olinadi va u asosida chiziladi.

Xaqiqiy uzunlikni chizmadagi uzunlikka nisbati uzunlik masshtabi deyiladi.



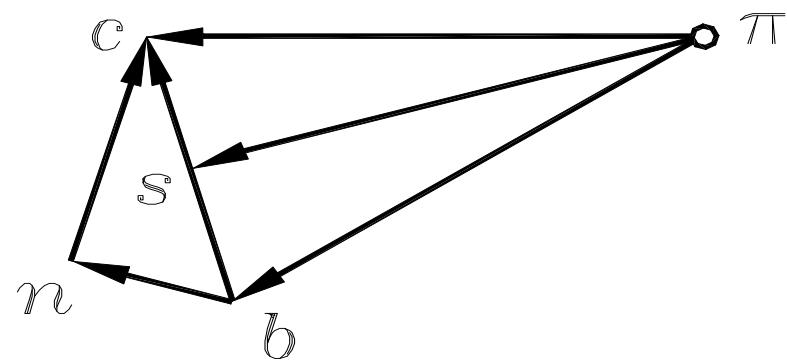
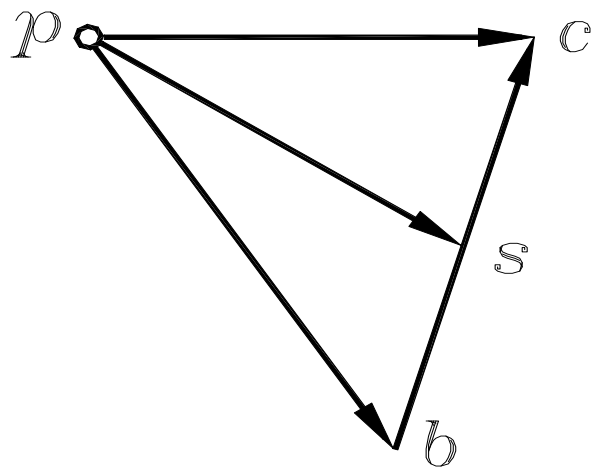


**Tekislikda aylanuvchi
mexanizm bo'g'in
nuqtalarining tezlik va
tezlanishlarini topish.**



$$\mu_v = \mu_1 \omega_1 \left(\frac{m}{c \cdot mm} \right)$$

$$\mu_a = \mu_1 \omega_1^2 \left(\frac{m}{c^2 \cdot mm} \right)$$



$$\overline{v_B} = \overline{pb} = \perp \overline{AB}$$

$$\overline{a_B^n} = \overline{\pi b} = \parallel \overline{AB}$$

$$\overline{v_{CB}} = \overline{bc} \perp \overline{BC}$$

$$\overline{a_{CB}^n} = \overline{bn} \parallel \overline{BC} \left. \vphantom{\overline{a_{CB}^n}} \right\} \overline{a_{CB}} = \overline{bc}$$

$$\overline{v_C} = \overline{pc} \parallel \overline{напр}$$

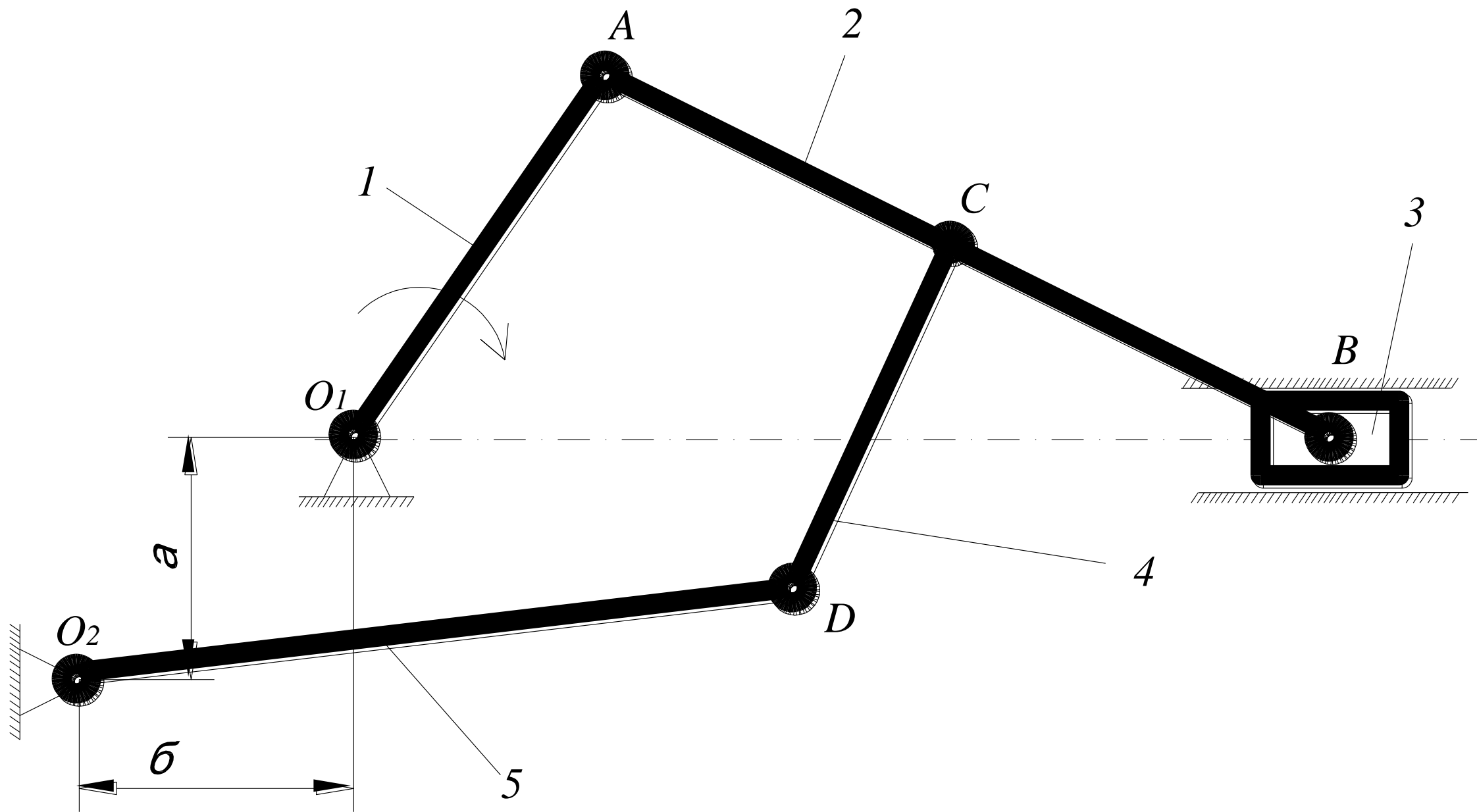
$$\overline{a_{CB}^\tau} = \overline{nc} \perp \overline{BC}$$

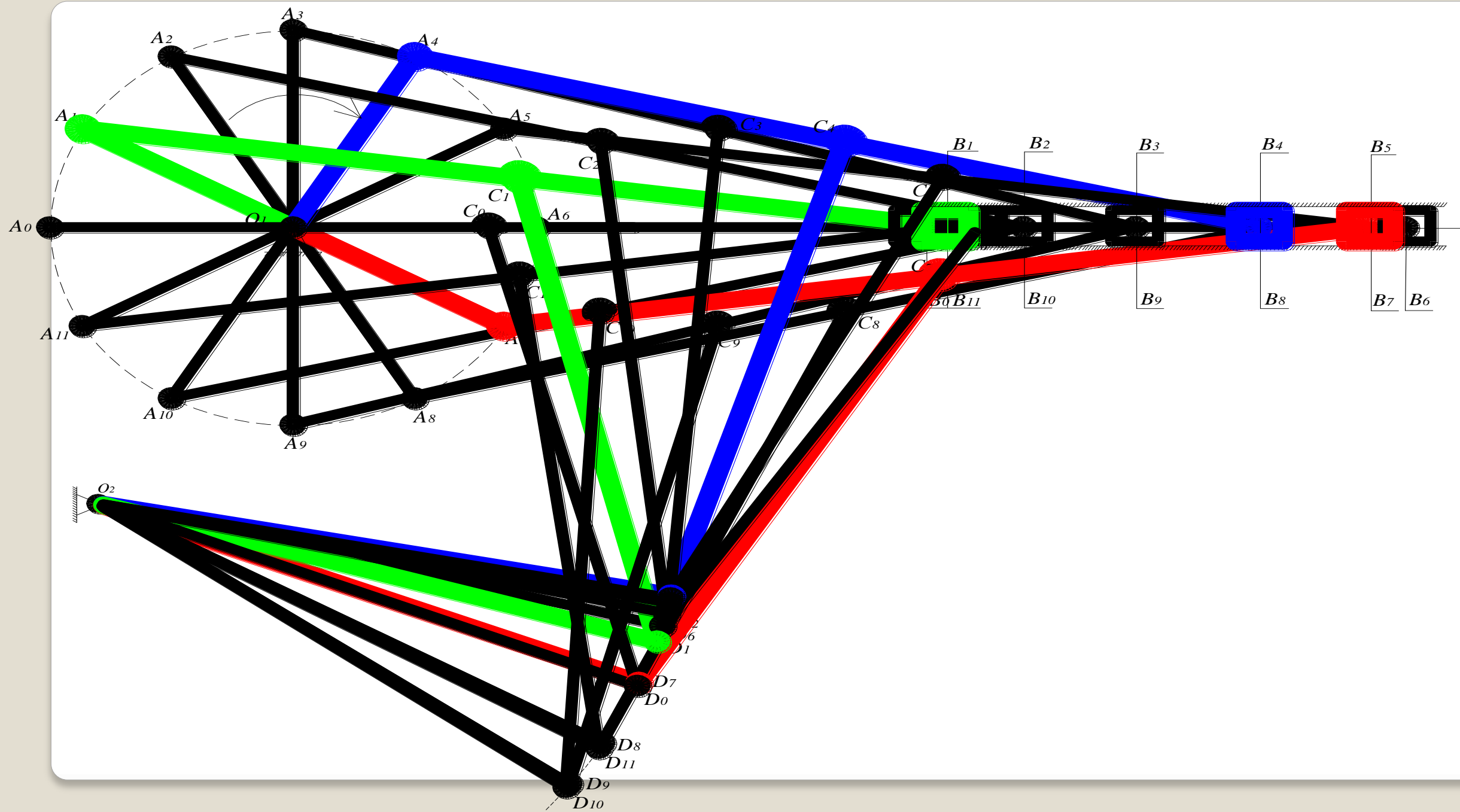
$$\overline{v_S} = \overline{ps}$$

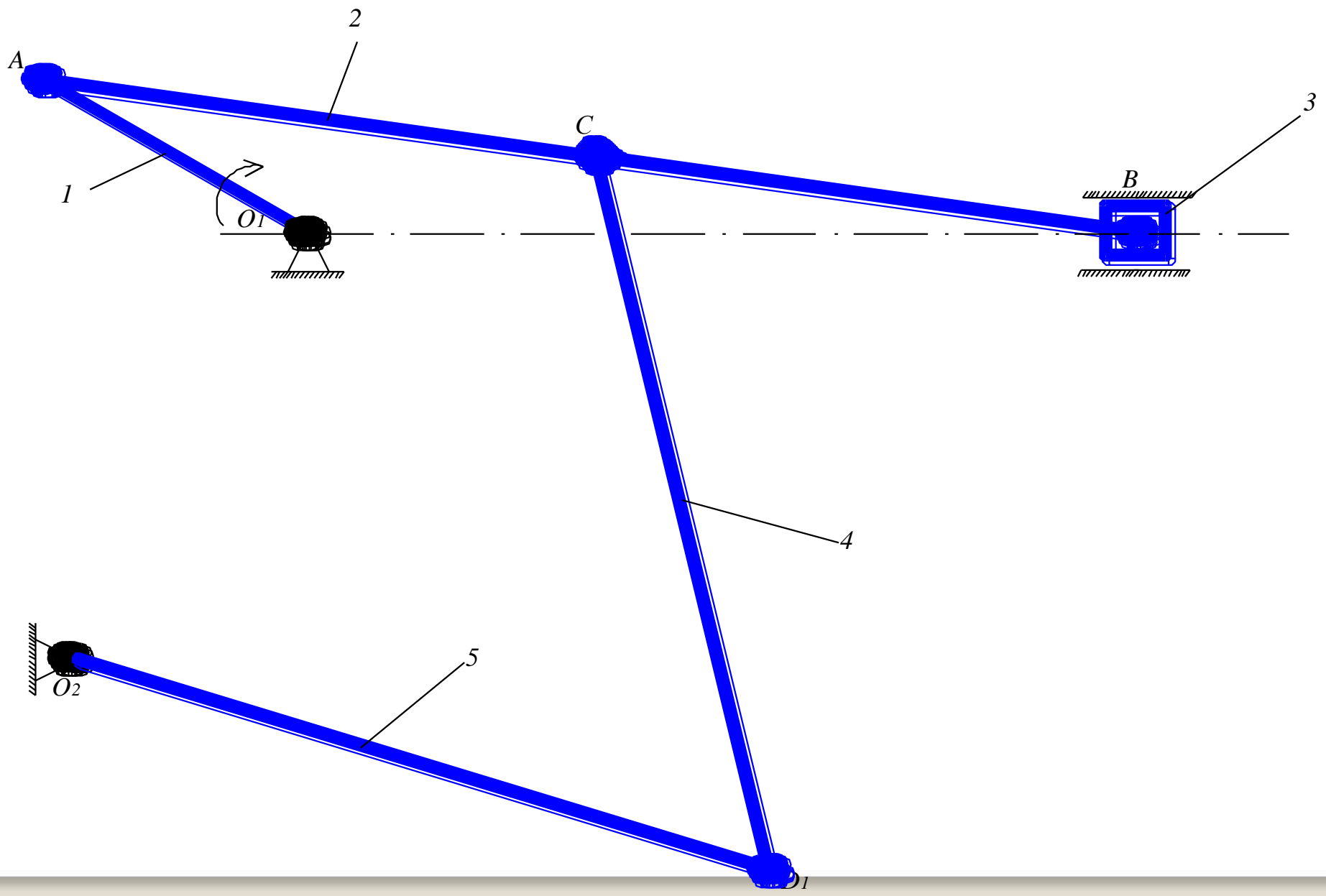
$$\overline{a_C} = \overline{\pi c} \parallel \overline{напр}$$

$$\overline{a_S} = \overline{\pi s}$$

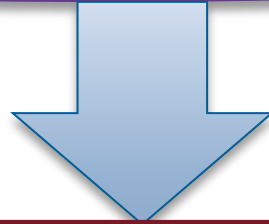
$$\omega_2 = \frac{v_{CB}}{BC} = \frac{\overline{v_{CB}} \mu_v}{\overline{BC} \mu_1} = \frac{\overline{bc} \mu_1 \omega_1}{\overline{BC} \mu_1}$$







Vektor tenglama tuzamiz



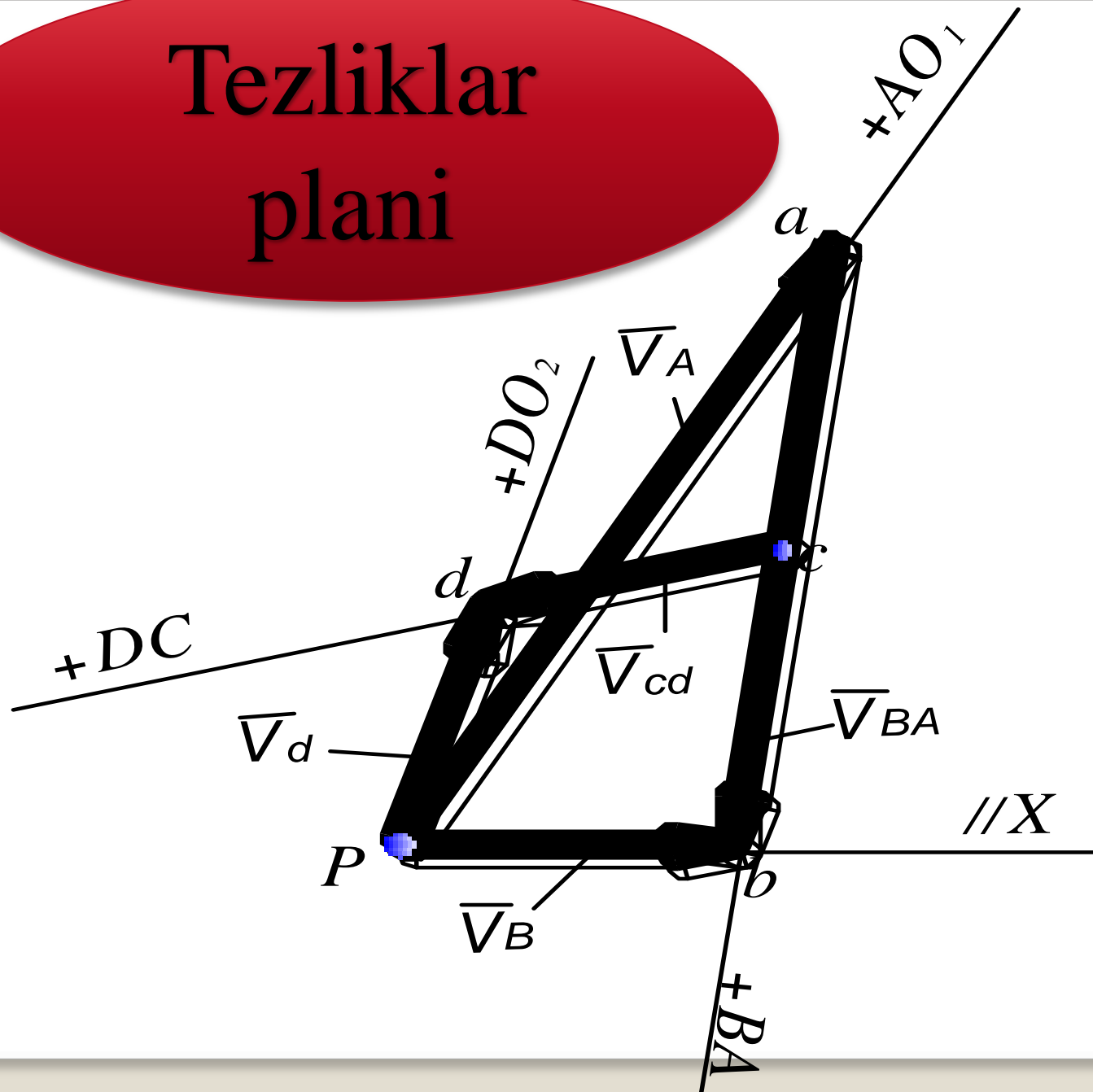
$$\vec{V}_A = \frac{\vec{V}_{O_1}}{=0} + \frac{\vec{V}_{AO_1}}{\perp AO_1} \quad \vec{V}_B = \frac{\vec{V}_A}{=} + \frac{\vec{V}_{BA}}{\perp BA} \quad \vec{V}_B = \frac{\vec{V}_X}{=0} + \frac{\vec{V}_{BX}}{// X}$$

$$\vec{V}_D = \frac{\vec{V}_{O_2}}{=0} + \frac{\vec{V}_{DO_2}}{\perp DO_2} \quad \vec{V}_D = \frac{\vec{V}_C}{=} + \frac{\vec{V}_{DC}}{\perp DC}$$

A n. tezligni O_1A ga perpendikulyar va aylanish tomoniga yo'nalgan. Tezliklar planini qutbini tanlab olib undan pa kesmani O_1A ga perpendikulyar qilib o'tkazamiz. Kesma pa A n. tezligini ifodalaydigan chizmadagi vektor uzunligi, uning uzunligi ihtiyoriy tanlab olinadi $Pa = 50 \text{ mm}$ (30 – 70 tavsiya etiladi).

$$V_A = \omega_1 \ell_{O_1A} = \frac{\pi \cdot n_1}{30} \cdot \ell_{O_1A}$$

Tezliklar plani



Tezliklar planidan foydalanib
har qanday nuqtaning tezligini
aniqlash mumkin



$$V_{AB} = \mu_V \cdot ab \quad V_B = \mu_V \cdot pb \quad V_{CD} = \mu_V \cdot cd \quad V_{O_2D} = \mu_V \cdot Pd$$

$$\omega_1 = \frac{\pi \cdot n_1}{30} \quad \omega_2 = \frac{V_{BA}}{\ell_{AB}} \quad \omega_3 = \frac{V_B}{\ell_{O_2B}} \quad \omega_4 = \frac{V_{CD}}{\ell_{CD}} \quad \omega_5 = \frac{V_{DO_2}}{\ell_{DO_2}}$$

Tezliklar planlarining tasviriy hossalari.



- ❖ Tezliklar planning qutb tezligi nolga teng bo'lgan nuqtalarini tasvirlaydi.
- ❖ Qutbda boshlanadigan vektorlar absolyut tezliklarni ifodalaydi.
- ❖ Absolyut tezliklar uchlarini tutashtiradigan vektorlar nisbiy tezliklarni ifodalaydi.

Tezlanishlar planini qurish.

Tezliklar mexanizmda tezlik plani yordamida topilsa, tezlanishlar mexanizmda tezlanishlar plani yordamida topiladi. Tezlanish plani – bu nuqtaning absolyut va nisbiy tezlanish vektoridan qurilgan ko'pburchakdir.

Tezlanish vektor tenglamalari

$$\left\{ \begin{array}{l} \vec{a}_A = \frac{\vec{a}_{O_1}}{= \mathbf{0}} + \frac{\vec{a}_{AO_1}^n}{// AO_1} \\ \vec{a}_B = \frac{\vec{a}_A}{=} + \frac{\vec{a}_{BA}^n}{// BA} + \frac{\vec{a}_{BA}^t}{\perp BA} \\ \vec{a}_B = \frac{\vec{a}_X}{= \mathbf{0}} + \frac{\vec{a}_{BX}^n}{// X} \\ \vec{a}_D = \frac{\vec{a}_C}{=} + \frac{\vec{a}_{DC}^n}{// DC} + \frac{\vec{a}_{DC}^t}{\perp DC} \\ \vec{a}_D = \frac{\vec{a}_{O_2}}{= \mathbf{0}} + \frac{\vec{a}_{DO_2}^n}{// DO_2} + \frac{\vec{a}_{DO_2}^t}{\perp DO_2} \end{array} \right.$$

Tezlanishlar planini qurish kirish bo'g'ida joylashgan nuqtalarning tezlanishini aniqlashdan boshlanadi. O_1 nuqta qo'zg'almas nuqta va uning tezlanishi nolga teng. Tezlanishlar planning qutb o'rnini o'rnini tanlaymiz. Shu qutb tezlanishlari nolga teng nuqtalarini joylashtiramiz, O_1 va O_2 nuqtalarini.

A nuqtaning tezlanishi:

$$\vec{a}_A = \vec{a}_A^n + \vec{a}_A^t$$

Tangensial tezlanish nolga teng, chunki kirish bo'g'ini o'zgarmas tezlik bilan aylanadi va uning burchak tezlanishi quyidagicha:

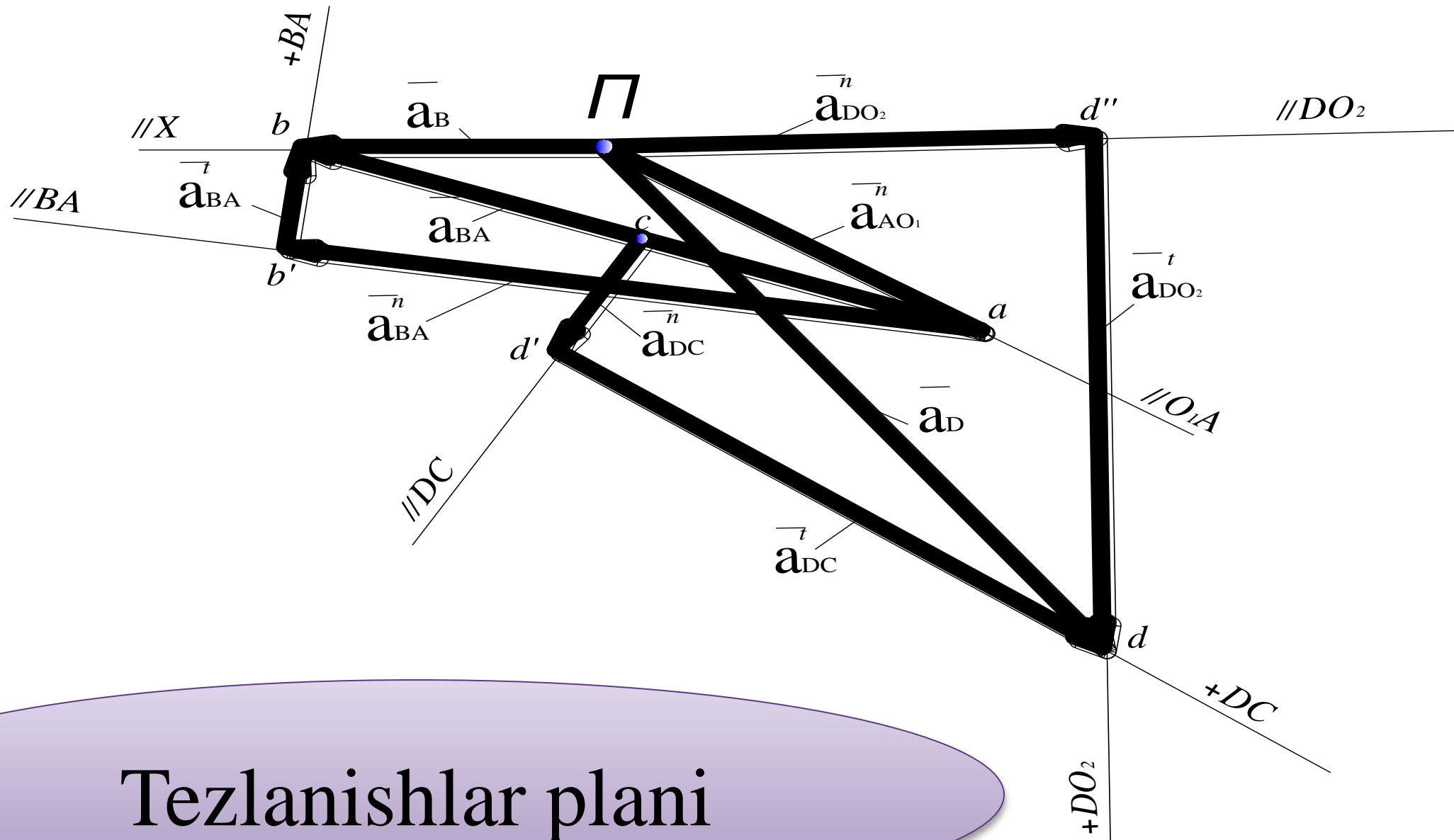
$$a_A^t = \varepsilon \cdot \ell_{O_1A} = 0$$

$$a_A^n = \omega_1^2 \cdot \ell_{OA}$$

Normal tezlanish:

Tezlanishlar palnini masshtabi:

$$\mu_A = \frac{a_A^n}{\pi a}$$



Tezlanishlar plani

Normal tezlanishlarni hisoblab topamiz

$$a_{BA}^n = \frac{V_{BA}^2}{l_{BA}} = \frac{(\mu_V \cdot ab)^2}{l_{AB}}$$

$$a_{DC}^n = \frac{V_{DC}^2}{l_{DC}} = \frac{(\mu_V \cdot dc)^2}{l_{DC}}$$

$$a_{DO_2}^n = \frac{V_{DO_2}^2}{l_{DO_2}} = \frac{(\mu_V \cdot pd)^2}{l_{DO_2}}$$

Shu tezlanishlarni ifodalaydigan chizmadagi uzunliklar:

$$n_{BA} = \frac{a_{BA}^n}{\mu_a} \qquad n_{DC} = \frac{a_{DC}^n}{\mu_a}$$

$$n_{DO_2} = \frac{a_{DO_2}^n}{\mu_a}$$

Tezlanishlarning son qiymatlari:

$$a_B = \mu_a \cdot \pi b$$

$$a_{BA}^t = \mu_a \cdot t_{BA}$$

$$a_{CD} = \mu_a \cdot cd$$

$$a_{CD}^t = \mu_a \cdot t_{BA}$$

$$a_{DO_2} = \mu_a \cdot \pi d$$

$$a_{DO_2}^t = \mu_a \cdot t_{DO_2}$$

Bo'g'inlarning burchak tezlanishlari:

$$\varepsilon_1 = 0$$

$$\varepsilon_2 = \frac{a_{BA}^t}{l_{BA}}$$

$$\varepsilon_4 = \frac{a_{DC}^t}{l_{DC}}$$

$$\varepsilon_3 = 0$$

$$\varepsilon_5 = \frac{a_{DO_2}^t}{l_{DO_2}}$$

Tezlanishlar planining tasviriy hossalari.

- ❑ Tezlanishlar planining π qutbida boshini olgan kesmalar nuqtalarining absolyut tezlanishlarini tasvirlaydi.
- ❑ Absolyut tezlanishlarning uchlarini tutashtiradigan kesmalar nuqtalarining nisbiy tezlanishlarini ifodalaydi.
- ❑ Planlar qutbi tezlanishlari nolga teng bo'lgan nuqtalarini tasvirlaydi.

Beshikdan to qabrgacha
ilm izla.