



**O'ZBEKISTON RESPUBLIKASI
OLIY VA O'RTA MAXSUS TA'LIM VAZIRLIGI**

**«TOSHKENT IRRIGATSIYA VA QISHLOQ XO'JALIGINI
MEXANIZATSIYALASH MUHANDISLARI INSTITUTI»
MILLIY TADQIQOT UNIVERSITETI**



**«NAZARIY VA QURILISH MEXANIKASI»
KAFEDRASI**

FAN: NAZARIY MEXANIKA

MA"RUZACHI:

TEXNIKA FANLARI NOMZODI, DOTSENT

**Xudaynazarov Sherzod
Ochilovich**



TOSHKENT-2022

2-ma'ruza.

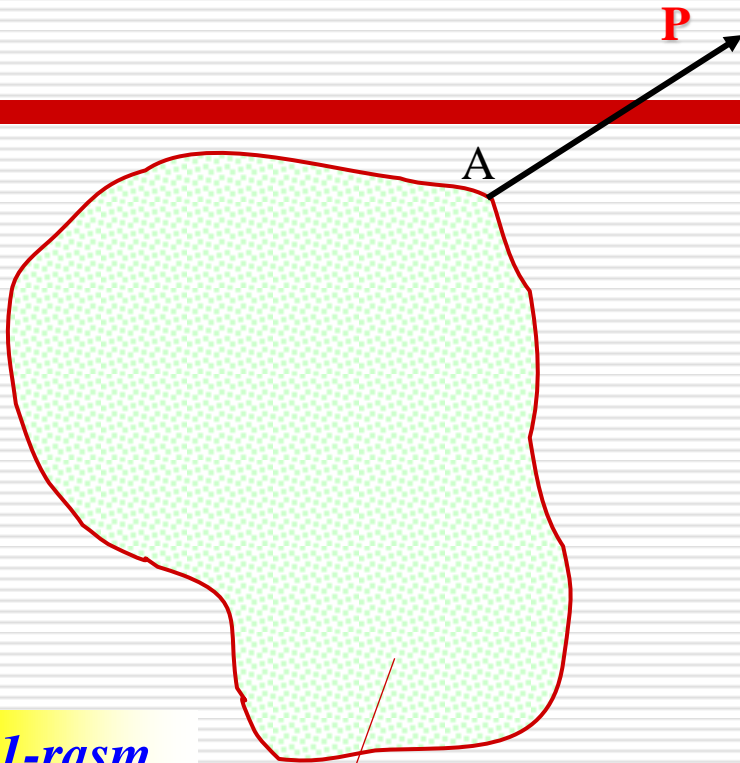
Tekislikdagi kuchlar sistemasi. Juft kuch. Juft kuchning xossalari.

REJA:

- 1. Kuchning nuqtaga nisbatan momenti.**
- 2. Kuchning o`qqa nisbatan momenti.**
- 3. Juft kuch va uning momenti. Juft kuchlarning muvozanat shartlari.**



Kuchning nuqtaga nisbatan momenti



1-rasm

*moddiy ob'ekt – qattiq jism.
konkret masalalar ko'rilganda real jism olinadi.*

kuch vektori:

- qo'yilish nuqtasi
- yo'nalishi
- qiymati (moduli)

bilan xarakterlanadi.

nuqtaga qo'yilgan kuch
to'plangan kuch deb ataladi.
bu tushuncha shartli bo'lib, u kuchning
ta'sir yuzasi nisbatan kichik bo'lgan
xolda o'rinli bo'ladi.

boshqa kuchlar bo'lmaganda, yagona ta'sir
etuvchi kuch jismning kuch yo'nalishi
bo'yicha ko'chishiga olib keladi.



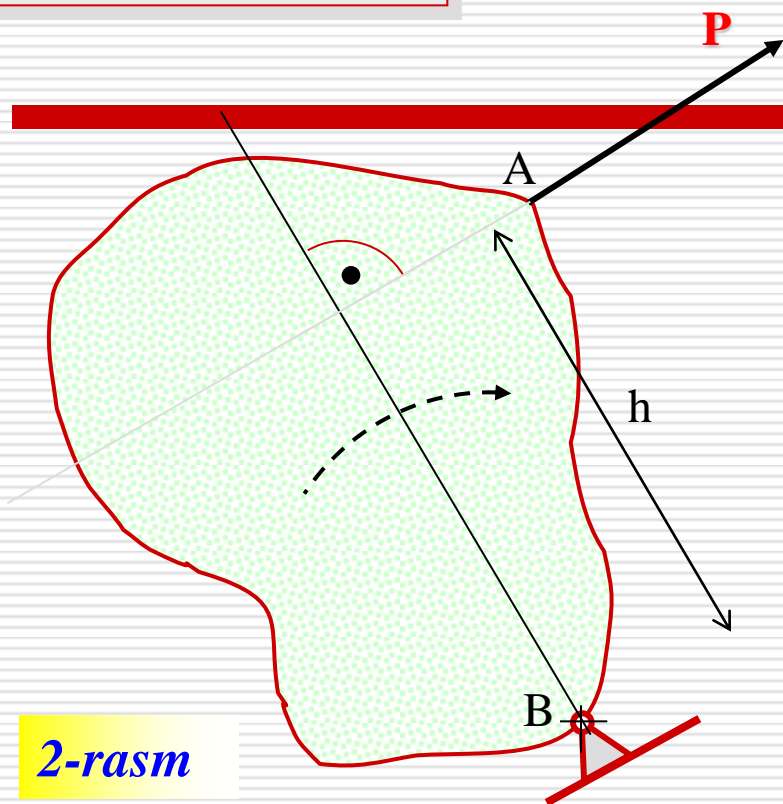
kuch, kuch momenti

kuch momentining simvolik tarzda yozilishi:

$m_B(P)$

kuch vektorining nomi

moment hisoblanayotgan nuqtaning nomi

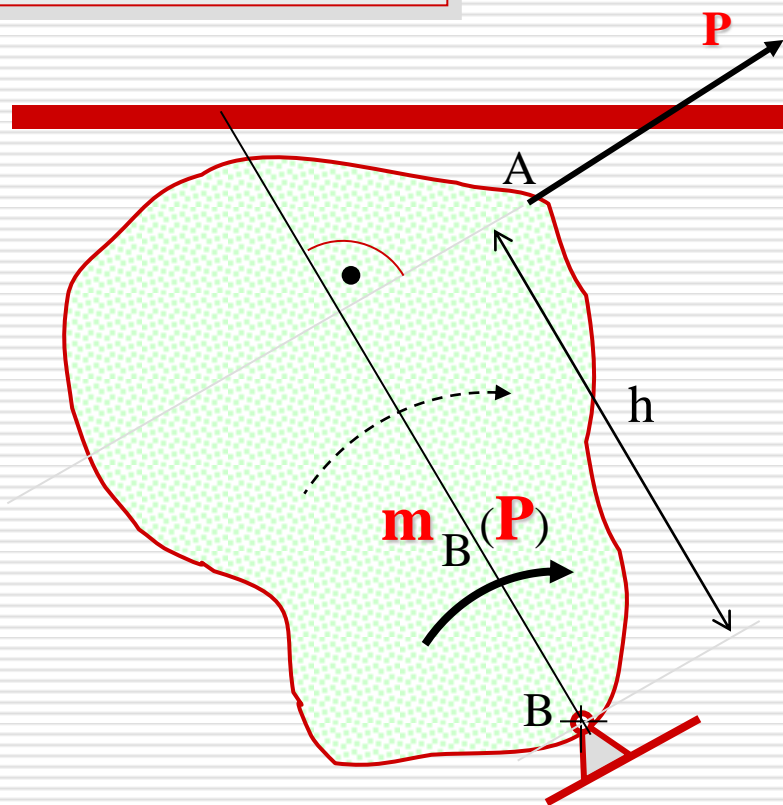


2-rasm

aylantirish effekti (masalan, jismning aylanish tezligi) xam (P) kuchning qiymatiga, ham jism mahkamlangan nuqtadan kuch ta'sir chizigigacha (h) masofaga **proportsional** bo'ladi.



kuch, kuch momenti



3-rasm

kuch momentining simvolik tarzda yozilishi:

$$m_B(\mathbf{P})$$

kuch vektorining nomi

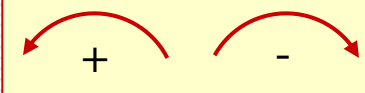
moment hisoblanayotgan nuqtaning nomi

kuch momentining qiymati:

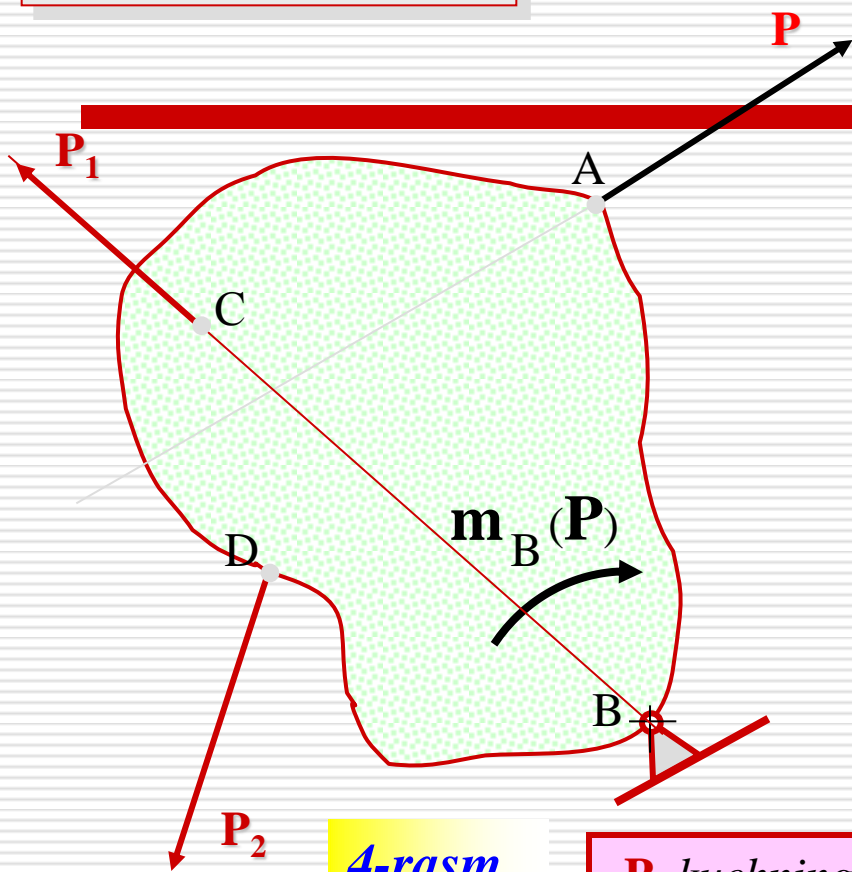
$$m_B(\mathbf{P}) = \pm \mathbf{P} * h$$

kuch elkasi

ishora qoidasi:



kuch, kuch momenti



4-rasm

javob:

Endi, sizni qay darajada tushunganingizni tekshiramiz:

P kuch momentining ishorasi qanday?

javob: minus.

P_2 kuch momentining ishorasi qanday?

javob: plus.

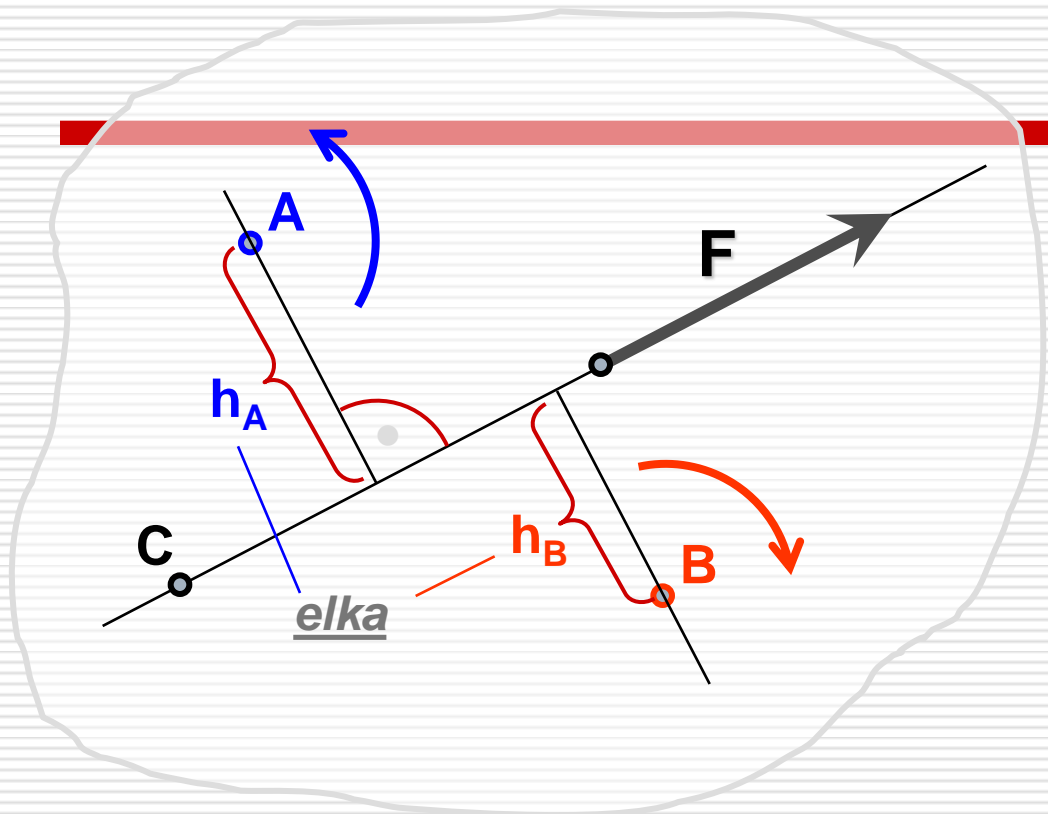
P_1 kuch momentining ishorasi qanday?

P_1 kuchning v nuqtaga nisbatan momenti nolga teng, kuchning ta'sir chizigi shu nuqtadan o'tadi, demak bu kuch elkasi nolga teng ekanini bildiradi.



nuqtaga nisbatan kuch momenti (*algebraik tushuncha*)

↪ aylantirish effekti



$m_i(F) = \pm F \cdot h_i$ — elka

ishoralar qoidasi:
↪ + ↻ -

$m_A(F) = + F \cdot h_A$

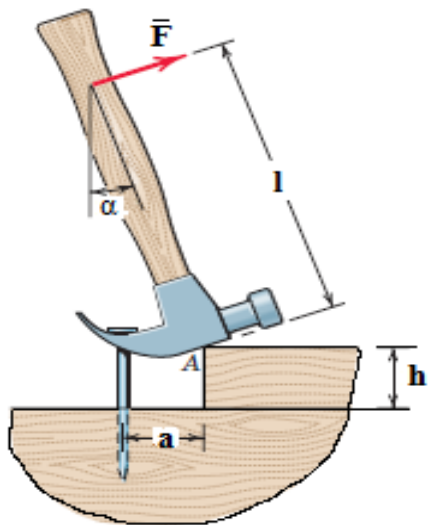
$m_B(F) = - F \cdot h_B$

$m_C(F) = 0$

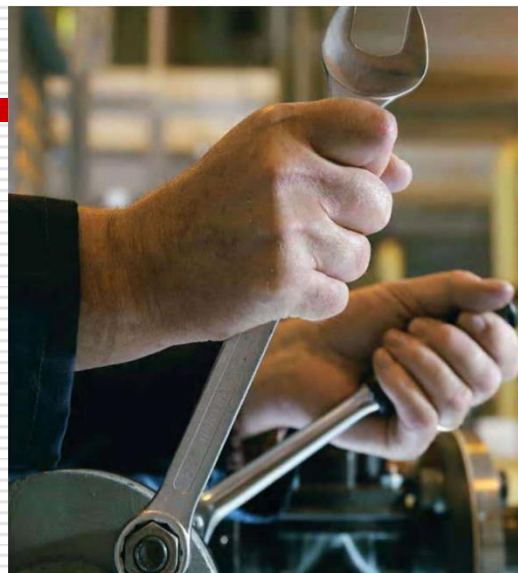
5-rasm



KUCH MOMENTI tushunchasidan foydalanish



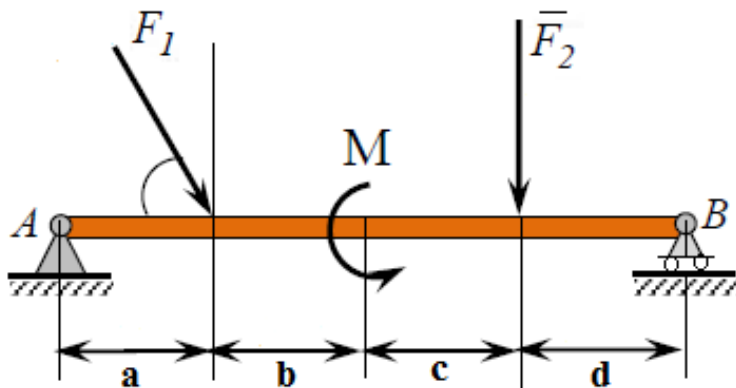
6-rasm



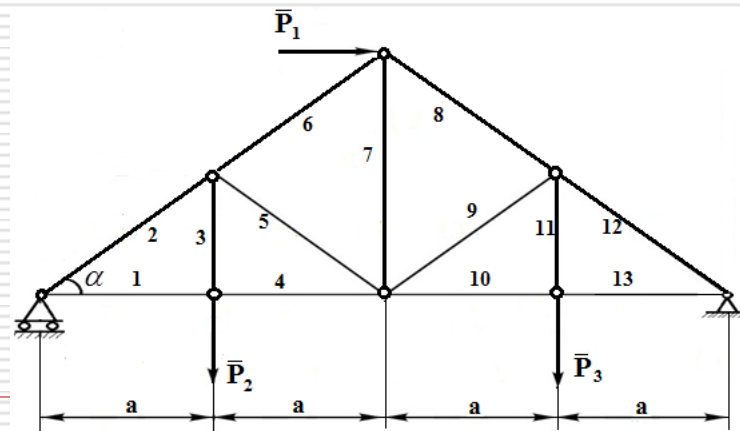
7-rasm



8-rasm

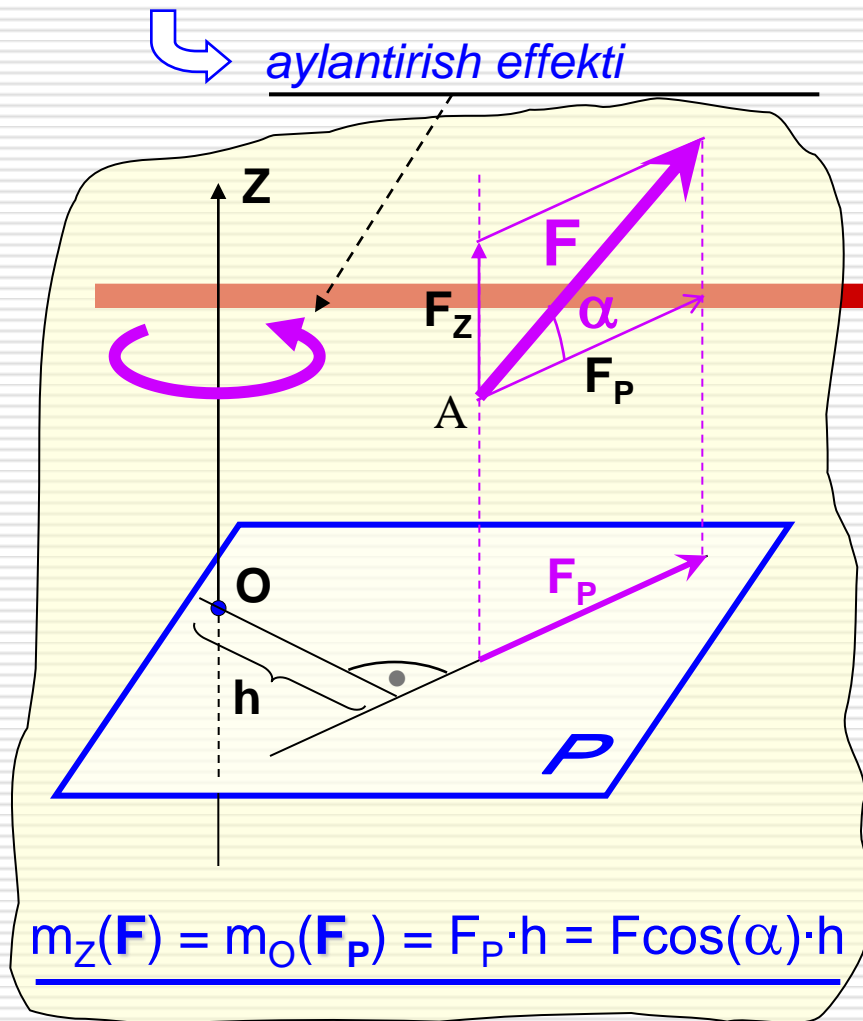


9-rasm



10-rasm

Kuchning o'qqa nisbatan momenti



\mathbf{P} tekislik \mathbf{Z} o'qqa perpendikulyar.
 \mathbf{F}_P – \mathbf{F} kuchning \mathbf{P} dagi proektsiyasi.

Kuchning (\mathbf{Z}) o'qqa nisbatan momenti skalyar miqdor bo'lib, u (\mathbf{F}_P) vektorning tekislik bilan kesishgan (o) nuqtaga nisbatan momentiga teng.

o'qning musbat uchidan qaraganda aylantirish effekti:

- ***soat mili yo'nalishida bo'lsa – minus;***
- ***soat mili yo'nalishiga teskari bo'lsa – plus.***

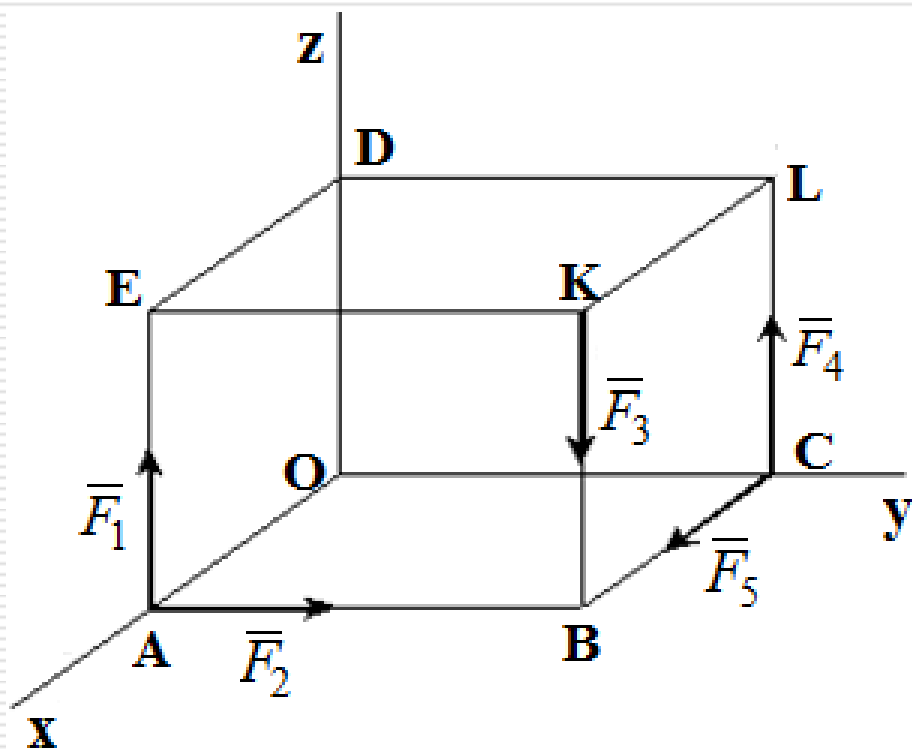


11-rasm

Kuchning o'qqa nisbatan momenti quyidagi xususiy hollarga ega:

1) Agar kuch o'qqa parallel yo'nalgan bo'lsa, kuchning shu o'qqa nisbatan momenti nolga teng bo'ladi;

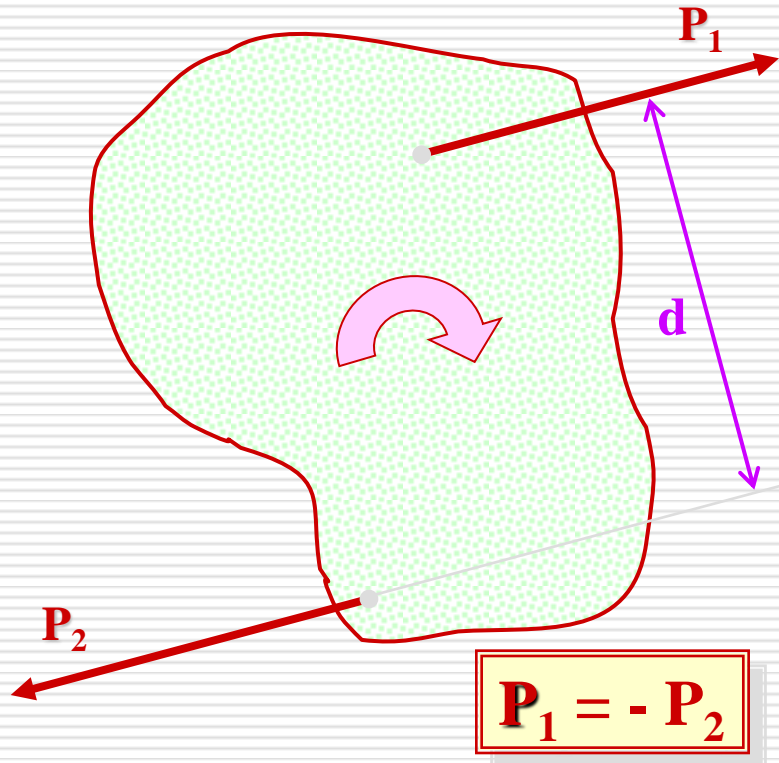
2) Kuchning ta'sir chizig'i o'qni kesib o'tsa, kuchning shu o'qqa nisbatan momenti nolga teng bo'ladi;



12-rasm

Juft kuch va uning momenti. Juft kuchlarning muvozanat shartlari.

Juft kuch – modul jihatidan teng, yo'nalishlari qarama-qarshi bo'lgan ikki parallel kuchdan tashkil topgan sistema



Juft tashkil etuvchi kuchlarning ta'sir chiziqlari orasidagi masofa **juftning elkasi** deyiladi.

Juft kuchning qattiq jismga ta'siri jismni aylantirish effekti bilan aniqlanadi va bu effekt quyidagilarga bog'liq:

1. juft kuch moduli va uning elkasi uzunligiga;
2. juft ta'sir tekisligi vaziyatiga;
3. shu tekislikning aylanish yo'nalishiga.

13-rasm

Juft aylantirish effekti ning miqdoriy o'lchovi **juftning momenti** bilan xarakterlanadi.



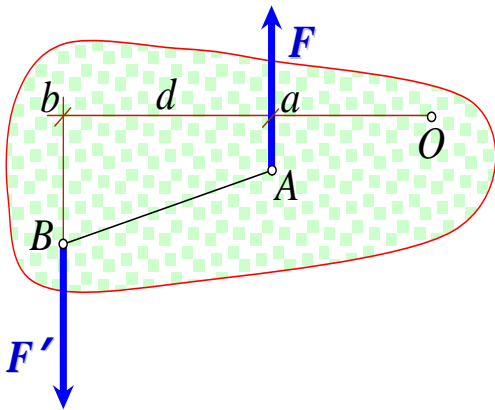
Juft kuch. Juft kuchning momenti

Juftning momenti deb, juft kuch tashkil etuvchi kuchlarning bittasini juftning elkasiga ko'paytmasining mos ishora bilan olingan kattalikka aytiladi. Juft momentini m yoki M bilan belgilanadi.

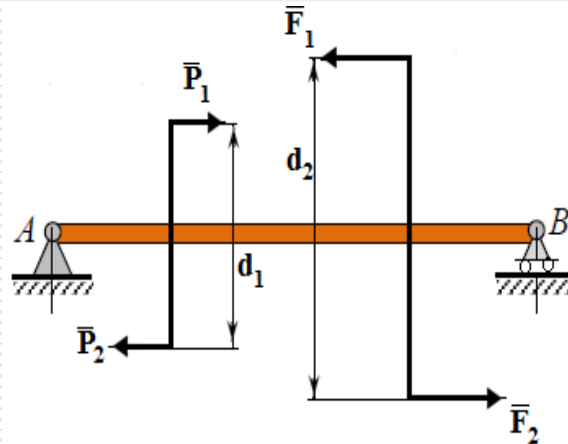
$$m = \pm Fd$$

$$m = m_B(\mathbf{F}) = m_A(\mathbf{F})$$

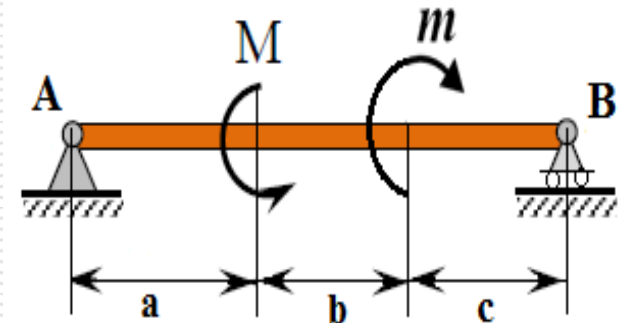
Agar juft jismni soat mili aylanishiga teskari yo'nalishda aylantirishga intilsa, juft momenti **musbat**, va aksincha, soat mili yo'nalishida aylantirishga intilsa – **manfiy** deb hisoblanadi.



14-rasm



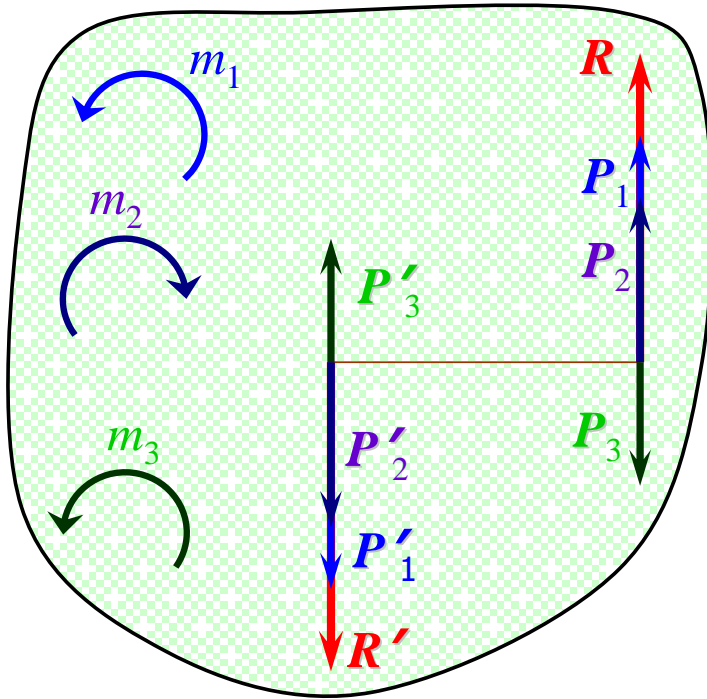
15-rasm



16-rasm

Tekislikdagi juftlarning muvozanat shartlari

teorema: bir tekislikda joylashgan juftlar sistemasi momenti shu juftlar momentlarining algebraik yigindisiga teng va ushbu tekislikda joylashgan bitta juftga ekvivalent bo'ladi.



17-rasm

$$M = \sum m_k$$

teoremadan chiqadigan xulosa: tekislikdagi juftlar sistemasi muvozanatda bo'lishi uchun bu juft momentlarining algebraik yigindisi nolga teng bo'lishi zarur va etarli, ya'ni

$$\sum m_k = 0$$

INSERT JADVALI

V	+	-	?

Insert jadvali:

- ma'lumotlarni sistemalashtirishni (mustaqil o'qish/ ma'ruza eshitish jarayonida olingan), ularni tasdiqlash, aniklashtirish yoki rad etish; qabul qilinayotgan ma'lumotning tushunarligini nazorat qilish, avval egallangan ma'lumotni yangisi bilan bog'lash qobiliyatlarini shakllantirishni ta'minlaydi;

- o'quv ma'lumotini mustaqil o'rganilganidan so'ng qo'llanadi.

Insert jadvalining tuzilishi va uni to'ldirish qoidasi bilan tanishadilar.



O'qish jarayonida olingan ma'lumotlarni individual holda sistemalashtiradilar;

Matnda qo'yilgan belgilar asosida jadval ustunlarini to'ldiradilar:

V - xaqidagi bilimlarimga javob beradi;

«-» - xaqidagi bilimlarimga zid;

+ - yangi ma'lumotlar

? – tushunarsiz (aniqlashtirish, to'ldirishni talab qiladi) ma'lumot.



NAZORAT SAVOLLARI

1. Kuch momenti deb nimaga aytiladi?
 2. Kuch yelkasi deb nimaga aytiladi?
 3. Kuch momenti qanday hossalarga ega?
-
4. Kuch momentining ishorasi qanday aniqlanadi?
 5. Juft kuch deb nimaga aytiladi?
 6. Juft teng ta'sir etuvchiga ega bo'ladimi?
 7. Juft momenti deb nimaga aytiladi?
 8. Tekislikdagi juftlarning muvozanat shartini aytib bering.
 9. Kuchning o'qqa nisbatan momenti deb nimaga aytiladi?
 10. Kuchning o'qqa nisbatan momenti qanday hossalarga ega?
 11. Kuchning o'qqa nisbatan momenti ishorasi qanday aniqlanadi?
 12. Kuchning o'qqa nisbatan momenti qanday hollarda nolga teng bo'ladi?

**E'TIBORLARINGIZ UCHUN
RAHMAT!**
