

## MATERIALLAR QARSHILIGI FANIDAN AMALIY TOPSHIRIQLARNI BAJARISH USLUBIYOTI

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### ANNOTATSIYA

*Maqolada keltirilgan masala kurs ishlarini bajarishda yuzaga keladigan xatoliklarni oldini olish uchun keltirilgan bo'lib, unda ketma-ketlik mavjud. Quyida keltirilgan hisob kitoblar bo'yicha amalga oshiriladi.*

**Kalit so'zlar:** *Shveller, sortament, inersiya moment, statik moment, bosh o'qlar, qarshilik momenti, inersiya radiusi, tekis shakllar, og'irlik markazi, inersiya momenti.*

### ABSTRACT

*The problem presented in the article is presented to prevent errors that may occur in the course work, in which there is a sequence.*

**KEY WORDS:** *Shveller, range, moment of inertia, static moment, Principal axes, moment of resistance, radius of inertia, Planar forms, Center of gravity, Moment of inertia of an arbitrary planar form.*

### KIRISH

O'zbekiston Respublikasining oliy ta'lim muassasalarida darsliklarning o'zbek imlo lug'atida, mazmunini va uslubini takomillashtirish imkoniyatlari kengaydi. Materiallar qarshiligi fani oliy ta'lim muassasalarining talabalariga turli konstruksiyalar, mashinalar detallari va inshootlarning mustag'kamligi, chidamliligi va ustivorligi hamda mustahkamlik, chidamlilik va ustivorlik shartlari bajarilishi uchun konstruksiyalar materiallarining sifati, ko'ndalang kesimlarining yuzalari, shakllari va holatlari qanday bo'lishi kerakligini hisoblash va tajribada sinashni o'rgatuvchi umummuhandis fanlar tizimiga kiradi. Maqola bakalavriyat yo'nalishi talabalariga materiallar qarshiligi fanini chuqur o'zlashtirib olishlariga o'z xissasini qo'shadi va to'plagan nazariy bilimlaridan amaliy masalalarni ishlashda ko'maklashishga

imkoniyat yaratadi. Ko‘p yillik tajribadan shu xulosaga kelindiki, talabalar fanni o‘zlashtirishda ba’zi bir qiyinchiliklarga duch kelishadi. Bu muammolarni hal qilishda masala yechish namunasi keltirildi.

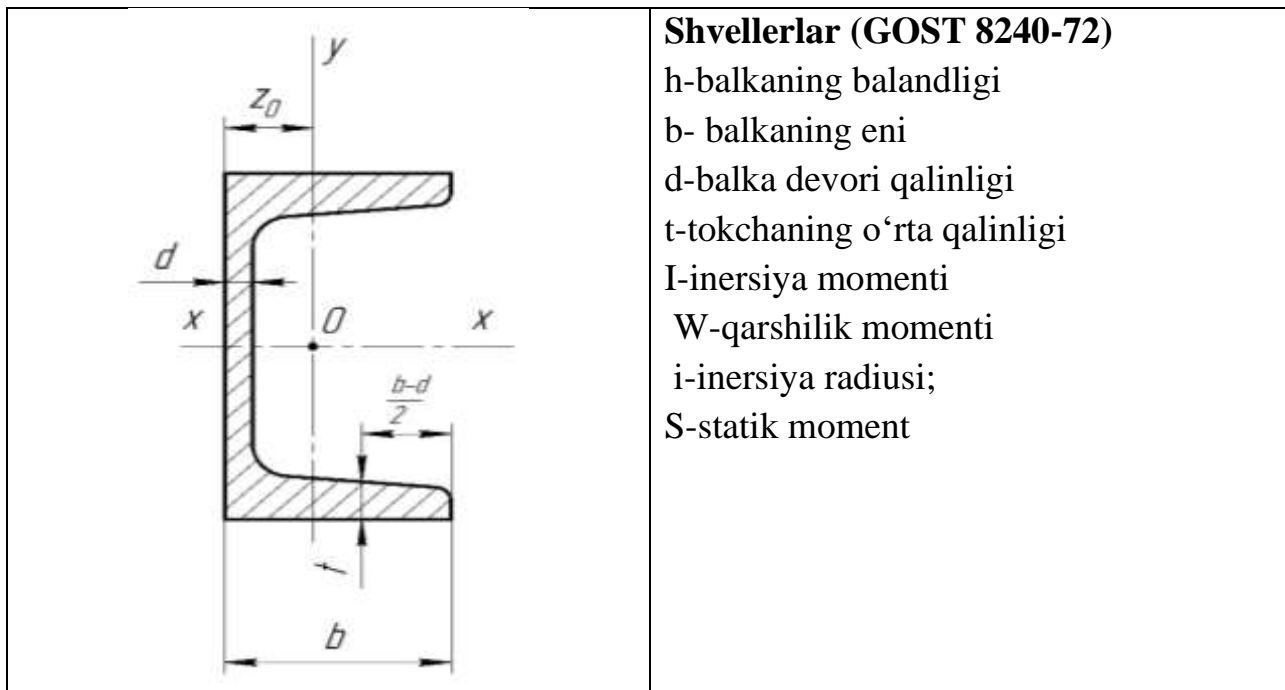
### ADABIYOTLAR TAHLILI VA METODOLOGIYA

Quyida keltirilgan adabiyotlarda tekis shakllarning geometrik tavsiflariga: shaklning yuzasi, statik, inersiya va qarshilik momentlari keltirib o‘tilgan. Oddiy shakllar uchun bu kattaliklarni aniqlash qiyinchilik tug‘dirmaydi. Ammo murakkab shakllar uchun ba’zi bir muammolarni hal qilish kerak. Adabiyotlarda materiallar qarshiligi bo‘yicha misol yechishda talabalar murakkab geometrik shakllarni geometrik tavsiflarini oddiy shakllarga keltirib aniqlashlari keltirib o‘tilgan. [www.openscience.uz](http://www.openscience.uz) ISSN 2181-0842 VOLUME 4, ISSUE 5 MAY 2023 “Mashina detallari mashg‘ulotlarida masala yechish uslubiyoti”; Eur. Chem. Bull. 2023, 12 (Special Issue8) Scops; Scops ISSN2063-5346 <https://www.eurchembull.com/issue?volume=Volume%20-12&issue=Special%20Issue-8&year2023> doi: 10.48047/ecb/2023.12.si8.018. Texnik mexanika mashg‘ulotlarida masala yechish uslubiyoti to‘g‘risidagi ma’lumotlar [https://drive.google.com/file/d/1GJzuiTGK\\_ITj7HReL8Pl6\\_yMqytgpgj1/view?usp=share\\_link](https://drive.google.com/file/d/1GJzuiTGK_ITj7HReL8Pl6_yMqytgpgj1/view?usp=share_link). da keltirib o‘tilgan. Unda masshtab asosida tekis yuza sortamentlarga mos ravishda tanlab olinadi va nazariy formulalar bilan ishlab chiqilishi bayon qilingan.

Berilgan tekis shakllar kesimi uchun shveller № 8 va shveller № 10 asosida sortament bo‘yicha qiymatlarni jadval-1 dan olib masalani yechamiz.

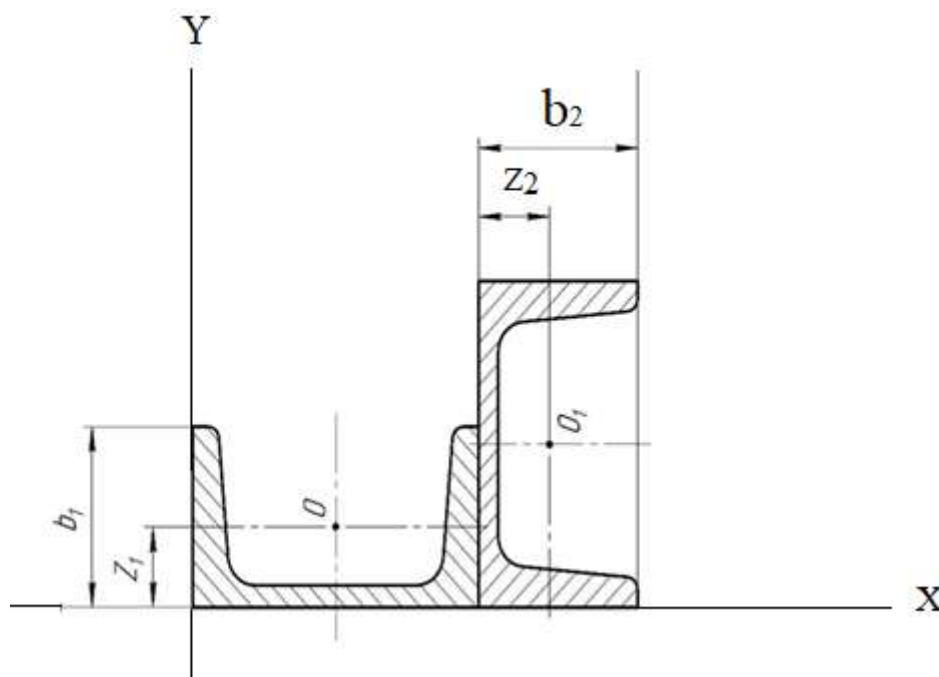
**Jadval-1**

№	O‘lchamlar, mm				Kesim yuzasi, sm <sup>2</sup>	$J_x$ sm <sup>4</sup>	$W_x$ sm <sup>3</sup>	$i_z$ sm	$S_x$ sm <sup>3</sup>	$J_y$ sm <sup>4</sup>	$W_y$ sm <sup>3</sup>	$i_y$ sm	$z_0$ cm
	h	b	d	t									
8	80	40	4,5	7,4	8,98	89,4	22,4	3,16	13,3	12,8	4,75	1,19	1,31
10	100	46	4,5	7,6	10,9	174	34,8	3,99	20,4	20,4	6,46	1,37	1,44



Prokatli po'lat shveller rasm-1

**Yechish:**1). Avvalo shvellerlarni masshtab asosida chizib olib ularga yordamchi o'qlar  $x$  ni joylashtiramiz(1-rasm).Umumiy yuzani  $x$  o'qlarga nisbatan statik momentlarini aniqlaymiz.So'ngra shakllarning simmetriya markazlaridan og'irlik markazini topib olib, umumiy og'irlik markazi koordinatalarini hisoblab chizmada  $S$  nuqtani belgilab olamiz.  $X_C, Y_C$ .



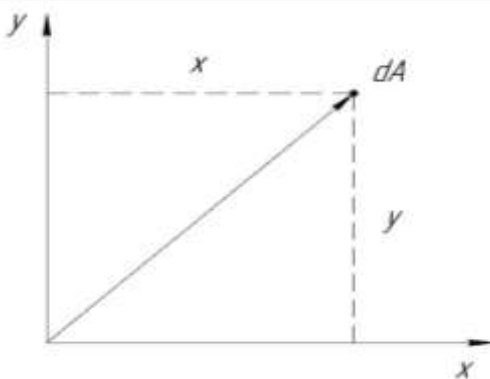
1-rasm

1) Umumiy yuzani topamiz.  $\sum F = F_1^{\text{MB}} + F_2^{\text{MB}} = 8,98 + 10,9 = 19,88 \text{ cm}^2$  umumiy yuza X o'qqa nisbatan statik momentlar. Tekis shakllarning statik momentlarini topishda tekis shaklning yuzasidan koordinata o'qigacha bo'lgan masofa tushuniladi (2-rasm). X o'qiga nisbatan statik moment  $S_x = \int y dA$ . U o'qiga nisbatan statik moment  $S_y = \int x dA$ .

$$S_x^{\text{MB1}} = F_1^{\text{MB}} \cdot z_1 = 8,98 \cdot 1,31 = 11,7638 \text{ cm}^3$$

$$S_x^{\text{MB2}} = F_2^{\text{MB}} \cdot \frac{h_2}{2} = 10,9 \cdot 1,44 = 15,696 \text{ cm}^3$$

## NATIJARLAR



2-rasm

X o'qi bo'yicha umumiy statik moment quyidagiga teng:

$$S_x = S_x^{\text{MB1}} + S_x^{\text{MB2}} = 11,7638 + 15,696 = 27,4598 \text{ cm}^3$$

U o'qqa nisbatan statik momentlar

$$S_y^{\text{MB1}} = F_1^{\text{MB1}} \cdot \frac{h_1}{2} = 8,98 \cdot 40 = 359,2 \text{ cm}^3$$

$$S_y^{\text{MB2}} = F_2^{\text{MB2}} \cdot (h_1 + Z_2) = 10,9 \cdot (80 + 1,44) = 887,696 \text{ cm}^3$$

Y o'qi bo'yicha umumiy statik moment quyidagiga teng:

$$S_y = S_y^{\text{MB1}} + S_y^{\text{MB2}} = 359,2 + 887,696 = 1246,896 \text{ cm}^3$$

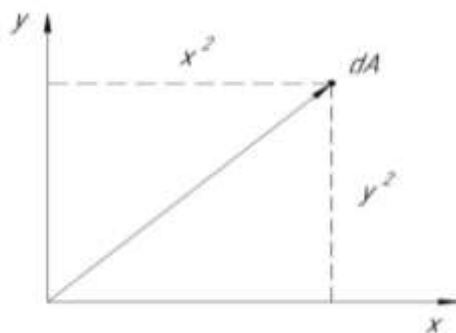
2) Og'irlik markazini shvellerlarning og'irlik markazlaridan o'tkazilgan yordamchi XU o'qlarga nisbatan topamiz:  $S_x = Y_C (F_1^{\text{MB}} + F_2^{\text{MB}})$ , bu yerdan umumiy tekis shakllar kesimi uchun  $Y_C$  og'irlik markazi koordinatasi

$$Y_C = \frac{S_x}{(F_1^{\text{MB}} + F_2^{\text{MB}})} = \frac{27,4598}{19,88} = 1,38127 \text{ cm}$$

$S_y = X_C (F_1^{\text{MB}} + F_2^{\text{MB}})$  bu yerdan  $X_C$  og'irlik markazi koordinatasi

$$X_C = \frac{S_y}{(F_1^{\text{MB}} + F_2^{\text{MB}})} = \frac{1246,896}{19,88} = 62,7211 \text{ cm}$$

3)  $X_C$  va  $Y_C$  o'qlarga nisbatan inersiya momentlarini hisoblaymiz (3-rasm). Ixtiyoriy tekis shaklning inersiya momenti, tekis shakl yuzasini koordinata o'qigacha bo'lgan masofa kvadratiga ko'paytmasi: X o'qiga nisbatan.  $J_x = \int y^2 dA$  va Y o'qiga nisbatan  $J_y = \int x^2 dA$



3-rasm

$$I_x = I_{x1}^{III B} + (z_1)^2 \cdot F_1^{III B} + I_{x2}^{III B} + \left(\frac{h_2}{2}\right)^2 \cdot F_2^{III B} =$$

$$89,4 + (1,31)^2 \cdot 8,98 + 174 + \left(\frac{100}{2}\right)^2 \cdot 10,9 = 27524,0961 \text{ cm}^4$$

$$I_y = I_y^{III B1} + \left(\frac{h_1}{2}\right)^2 \cdot F_1^{III B} + I_y^{III B2} + (h_1 + Z_2)^2 \cdot F_2^{III B}$$

$$= 12,8 + (40)^2 \cdot 8,98 + 20,4 + (40 + 1,44)^2 \cdot 10,9 = 33119,48224 \text{ cm}^4$$

Bu yerda:  $h_1, b_2, b_1, h_2$  lar shvellerlar uchun jadval-1 dan olinadi.

4) Markazdan qochma inersiya momentlari. Tekis shaklning markazidan qochma inersiya momenti XY koordinata o'qlari o'zaro qiymatlari va yuza ko'paytmasi shaklida olinadi. Bu quyida o'z aksini topgan.

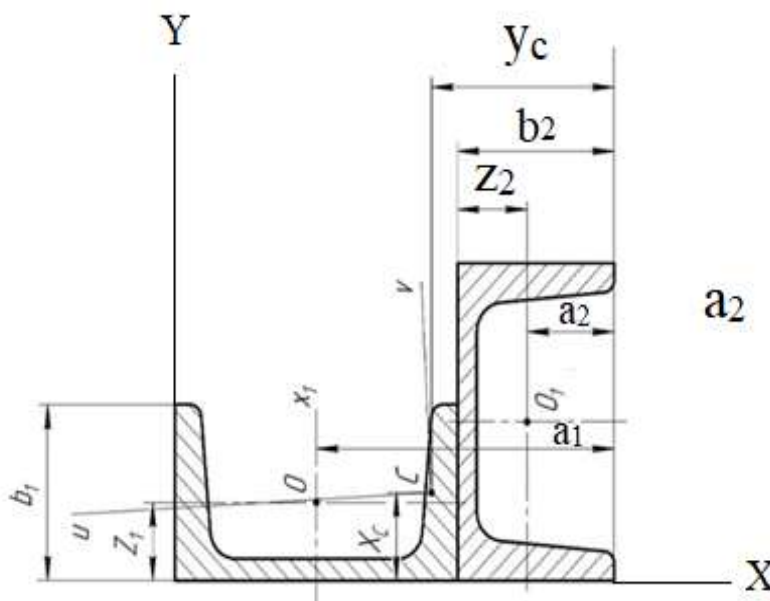
$$I_{xy} = I_{x_1 y_1} + F_1^{III B} \cdot a_1 \cdot a_3 + I_{x_1 y_1} + F_2^{III B} \cdot a_2 \cdot a_4$$

$$= 8,98 \cdot 1,31 \cdot 40 + 10,9 \cdot 50 \cdot (80 + 1,44) = 44855,352 \text{ cm}^4$$

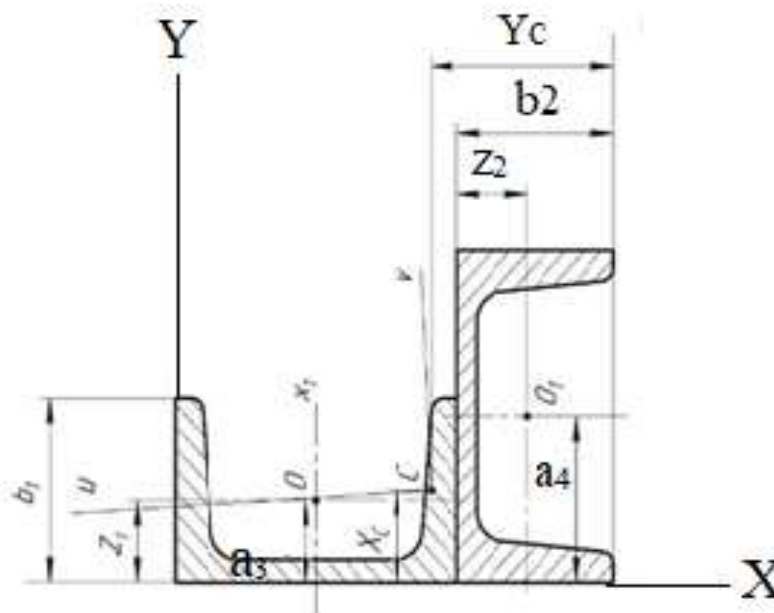
Bu yerda: Hisoblashni osonlashtirish uchun  $\frac{h_1}{2} = a_3; Z_1 = a_1;$

$\frac{h_2}{2} = a_2; h_1 + Z_2 = a_4$  deb olsak hisoblashda chalkashlik bo'lmaydi.

$a_1$  va  $a_2$  (4-rasm),  $a_3$  va  $a_4$  (5-rasm)



4-rasm



5-rasm

5) Markaziy bosh inersiya o‘qlarning holatini aniqlaymiz hamda  $\alpha$  бурчакни qo‘yib markaziy bosh o‘qlar u va v o‘qlarni o‘tkazamiz(6-rasm).  $X_c$  o‘qidan  $\alpha$  burchakni soat strelkasiga qarshi yo‘nalishi bo‘yicha qo‘yamiz. Chunki  $\alpha = -45^\circ$  qiymat

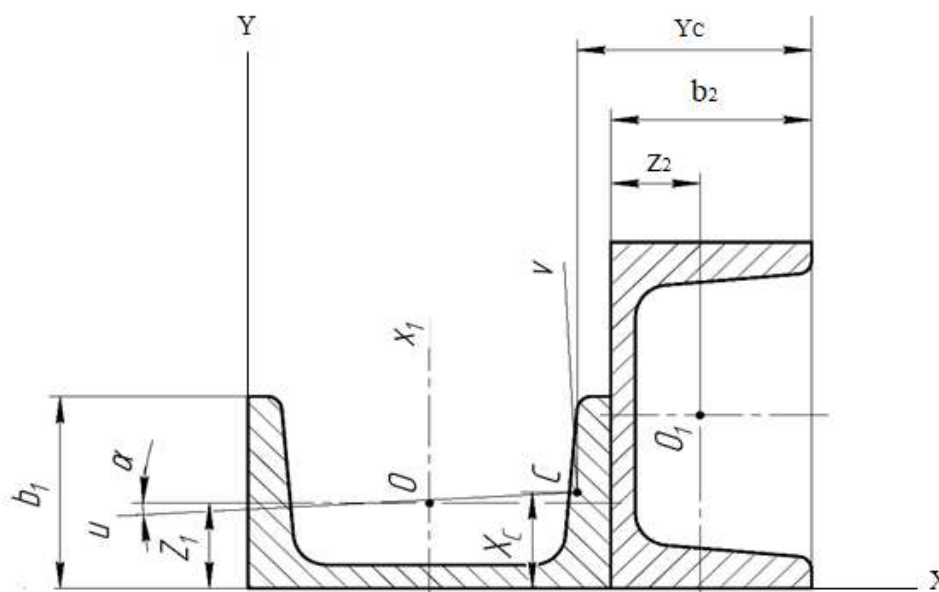
$$\text{manfiy. } \text{tg}2\alpha = \frac{2I_{xy}}{I_x - I_y} = \frac{2 \cdot 44855,352}{27524,0961 - 33119,48224} = -33116,222;$$

$$\text{tg}2\alpha = 33116,222 \text{ bu yerdan } \alpha = -45^\circ$$

6) Markaziy bosh inersiya momentlarini hisoblaymiz:

$$I_{\min}^{\max} = \frac{I_x + I_y}{2} \pm \frac{1}{2} \sqrt{(I_x - I_y)^2 + 4I_{xy}^2} \text{ formulaga qiymatlarini yuqoridagi hisob}$$

natijalaridan olib o‘rniga qo‘yib chiqamiz. Quyidagi ifoda kelib chiqadi



6-rasm

$$I_{min}^{max} = \frac{27524,0961+33119,48224}{2} \pm \frac{1}{2} \sqrt{(-5595,38614)^2 + 4 \cdot 44855,352}$$

Ifodani soddallashtirib oxirgi natijani topamiz.

$$I_{min}^{max} = 60643,57834/2 \pm \frac{1}{2} \cdot 5611,396213 \text{ cm}^4$$

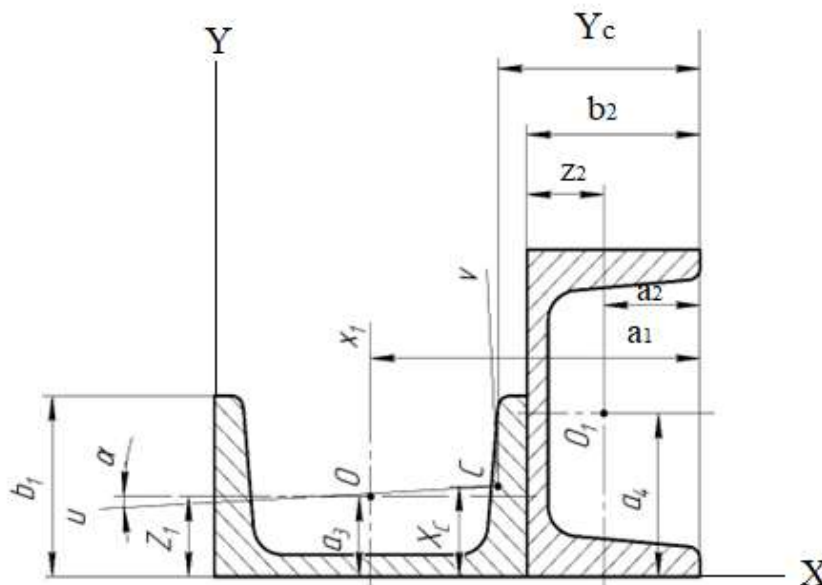
$$I_{min}^{max} = 30321,78917 \pm 2805,698 \text{ cm}^4$$

$$I_{max} = 30321,78917 + 2805,698 = 33127,48717; \text{ cm}^4$$

$$I_{min} = 30321,78917 - 2805,698 = 27516,09117 \text{ cm}^4$$

Bu yerdan  $I_{max} = 33127,48717 \text{ cm}^4$ ;  $I_{min} = 27516,09117 \text{ cm}^4$ ;

Umumiy grafik ko‘rinish (7-rasm):



7-rasm

## MUHOKAMA

7) Tekshirish:  $I_x + I_y = I_{max} + I_{min}$  bundan yuqorida olingan qiymatlarni tenglamaga qo‘yamiz. Tenglamani chap tarafida  $I_x + I_y = 27524,0961 + 33119,48224 \text{ cm}^4$ ; tenglamani o‘ng tomonida esa  $I_{max} + I_{min} = 33127,48717 + 27516,09117 \text{ cm}^4$ ; .Umumlashtirib tenglamani chap va o‘ng tomonlarini solishtiramiz:  $60643,57834 = 60643,57834$ . Demak masala to‘g‘ri ishlangan.

## XULOSA

Xulosa o‘rnida shuni ta’kidlash lozimki, hozirgi zamon globallashuv sharoitida sanoatda ishlab chiqarilayotgan prokat profillar, sortamentlar asosida turli hil metall konstruksiyalarni hisoblashda  $\pm 5 \%$  hisoblash xatoligi ruhsat etiladi. Bu nazariy jihatdan asoslangan.

## ADABIYOTLAR RO‘YXATI

1. Abdullayev, A.N. (2023). Methodology of calculation of mechanical transmission processes. "Ishlab chiqarishning texnik, muhandislik va texnologik muammolarining innovatsion yechimlari" Xalqaro miqyosidagi ilmiy-texnik anjuman 2022-yil 28-29-oktyabr, 825-829.

2. Abdullayev, A.N. (2023). Machine and mechanism theory of machine and mechanism design and research general methods. "Ishlab chiqarishning texnik, muhandislik va texnologik muammolarining innovatsion yechimlari" Xalqaro miqyosidagi ilmiy-texnik anjuman 2022-yil 28-29-oktyabr, 829-833.

3. Abdullayev, A.N. (2023). Amaliy mexanikadan amaliy mashg‘ulotlarda muammoli masala yechish uslubiyoti. Proceedings of International Conference on Educational Discoveries and Humanities Open Access | Peer Reviewed | Conference Proceedings [www.econferenceseries.com](http://www.econferenceseries.com) Volume 1, 1st October 2022. 75-79

4. Abdullayev, A.N. (2023). Pedagogical Description of the Formation of Professional Competence in Students of a Higher Education Institution. Vol. 4 No. 2 (2023): AJSHR March 9, 2023. American journal ajshr, "Global Research Network LLC" ISSN: 2690-9626 (online), Published by "Global Research Network LLC" under Volume: 4 Issue: 2 in Feb-2023 <https://globalresearchnetwork.us/index.php/ajshr>

5. Abdullayev, A.N. (2023). Methodology of labor education as one of the branches of pedagogy. pedagogical sciences and teaching methods conference. Copenhagen "Science Edition" 17 February 2023.

6. Abdullayev, A.N. (2023). Texnik mexanika mashg‘ulotlarida masala yechish uslubiyoti. "Science and Education" ilmiy elektron jurnal. Volume 4 Issue 4 soni [https://drive.google.com/file/d/1GJzuiTGK\\_ITj7HReL8PI6\\_yMqytgpgj1/view?usp=share\\_link](https://drive.google.com/file/d/1GJzuiTGK_ITj7HReL8PI6_yMqytgpgj1/view?usp=share_link). ISSN 2181-0842. APRIL 2023. 684-688