Mashina detallari mashg'ulotlarida masala yechish uslubiyoti

Abduxakim Nigmatovich Abdullayev
Toshkent davlat pedagogika universiteti

Annotatsiya: Maqolada keltirilgan masala kurs ishlarini bajarishda yuzaga keladigan xatoliklarni oldini olish uchun keltirilgan bo'lib, unda ketma-ketlik mavjud. Masala shartidan kerakli nazariy bilimlar keltirilib, hisob kitoblar bo'yicha amalga oshiriladi.

Kalit so'zlar: zanjirli uzatma, bir pog'onali silindrsimon egri tishli reduktor, uzatmalar soni, elektr dvigatel, uzatmalar soni, chiqish vali quvvati, chiqish vali aylanish chastotasi, elektrodvigatelning hisoblash quvvati

Methodology of problem solving in machine detail training

Abdukhakim Nigmatovich Abdullayev
Tashkent State Pedagogical University

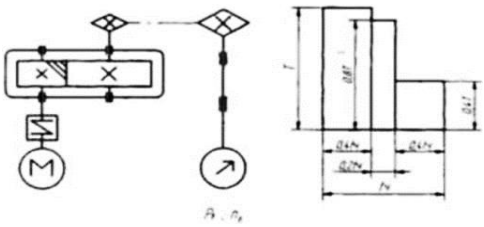
Abstract: The issue presented in the article is to avoid errors that occur when performing coursework, in which there is a sequence.From the condition of the issue, the necessary theoretical knowledge is brought, and the calculation is carried out according to the books.

Keywords: chain transmission, one-speed cylindrical curved gear reducer, number of transmissions, electric motor, number of transmissions, output valve power, output valve rotation frequency, calculation power of electrodvigatel

Zanjirli uzatmani hisoblash

Masalani yechish namunasi. 1-masalani yechish namunasi. Zanjirli uzatmani kinematik hisoblash. Yuritma bir pog'onali silindrsimon egri tishli reduktor va zanjirli uzatma (topshiriq bo'yicha yuritma sxemasi) dan iborat. Chiqish vali quvvati P_B, kVt - 2, 3. Chiqish vali aylanish chastotasi, n_v, daq^{-1} - 80.

Yuritmaning ishlatish muddati t_s, ming.s - 11, 0.



Yuritma sxemasi Yuklama grafigi

1-rasm. Yuritmaning umumiy FIKni aniqlash

Yuritmaning umumiy FIK quyidagi formula bo‘yicha aniqlanadi:$\eta_0 = \eta_1 \cdot \eta_2 \cdot \eta_n^m \cdot \eta_м$

bu yerda η_1 - egri tishli silindrsimon tishli uzatmaning FIK, η_2 - ochiq zanjirli uzatmaning FIK, $\eta_п$ - g‘ildirash podshipniklari juftliklari FIK, m - g‘ildirash podshipniklari juftliklari soni $\eta_м$ – mufta FIK. Jadvaldan η_1 = 0, 96; η_2= 0, 90...0, 93; $\eta_п$= 0, 99 ...0, 995 qiymatlarni olamiz; $\eta_м$= 0, 98 ... 1. Yuritma sxemasi bo‘yicha m = 3.η_1 = 0, 96; η_2 = 0, 90; $\eta_п$= 0, 995; $\eta_м$ = 1 deb olsak, u holda quyidagiga ega bo‘lamiz: η_0 =0, 96 • 0, 90 • 0, 995^3 • 1 = 0, 859

Elektrodvigatelning hisoblash quvvatini aniqlash:$P_p = \frac{P_р}{\eta_0} = \frac{2,3}{0,859} = 2,67$ кВт

Elektrodvigatelning o‘rtacha kvadratik quvvatini aniqlash: $P_{кв} = P_p\sqrt{\sum\left(\frac{T_i}{T_{max}}\right)} \cdot \frac{t_{чi}}{t_ч}$

bu yerda Ti - yuklanish siklogrammasining i-qismida yuklamaning xususiy qiymati; T_{chi} - yuklanish siklogrammasining i-qismida yuklama davomiyligining xususiy qiymati; T_{max} - davomiy yuklamaning eng katta qiymati; t_{ch} - uzatmaning ishlatish muddati.

$$P_{кв} = P_p \cdot \sqrt{\sum\left(\frac{1T}{T}\right)^2 \cdot \frac{0,4t_ч}{t_ч} + \left(\frac{0,8T}{T}\right)^2 \cdot \frac{0,2t_ч}{t_ч} + \left(\frac{0,4T}{T}\right)^2 \cdot \frac{0,4t_ч}{t_ч}}$$

$$P_{кв} = 2,67 \cdot \sqrt{(1)^2 \cdot 0,4 + (0,8)^2 \cdot 0,2 + (0,4)^2 \cdot 0,4} = 2,05 \text{ кВт}$$

GOST 19523-81 bo‘yicha 4A seriya uch fazali asinxron elektrodvigatelning nominal quvvatini R = 2, 2 kVt deb olamiz.Agar elektrodvigatel $R_{kv} > R_{nom}$ sharti bilan olinsa, u holda tanlangan elektrodvigatelni $\frac{P_{кв} - P_{ном}}{P_{ном}} \cdot 100\% \leq 3\%$ sharti bo‘yicha o‘ta yuklanishga tekshirish zarur. Bu shart bajarilmagan holda keyingi katta nominal quvvatli elektrodvigatel olinishi zarur.

Elektrodvigatel tanlash va yuritmaning umumiy uzatishlari sonini pog‘onalar bo‘yicha ajratish. *Elektrodvigatelning qabul qilingan nominal quvvati bo‘yicha katalogdan valining aylanish chastotasi turli bo‘lgan GOST 28330-89 bo‘yicha AIR va 5A seriyali to‘rtta elektrodvigatel tanlanadi. Ular uchun qiyosiy hisoblashni amalga oshiramiz. Hisoblashlarni 1-jadvalga joylashtiramiz.*

1-jadval

Yuritmaning umumiy uzatishlari sonini pog‘onalar bo‘yicha ajratish

Aniqlanayotgan parametrlar	Elektrodvigatel turi, R_{nom} = 2, 2kVt			
	5A80MV2	AIR90L4	AIR100L6	AIRM112MA8
Elektrodvigatelning aylanish chastotasi, $n_{кв}$ min^{-1}	2850	1425	945	710
Yuritmaning umumiy uzatishlari soni $U_0 = U_1U_2 = n_{dv}/n_v$	35, 625	17, 8125	11, 8125	8, 875
Zanjirli uzatma uchun tavsiya qilingan uzatish soni U_2	2, 55	2, 55	2, 55	2, 55

Reduktorning uzatish sonining hisoblangan qiymati U_1	14, 363	6, 985	4, 6324	3, 4804
GOST 2185-66 bo‘yicha reduktorning uzatish soni U_1	-	7, 1	4, 5	3, 55
Zanjirli uzatmaning uzatish sonining hisoblangan qiymati $U_2 = U_0/Ui$	-	2, 509	2, 625	2, 5

Jadval tahlili asosida va tavsiyalar hisobga olingan holda LIR90Ь4 markali elektrodvigatelni qayd qilingan tavsiyalar bo‘yicha eng maqbuli deb qabul qilamiz. U holda quyidagiga ega bo‘lamiz:

- yuritmaning umumiy uzatishlar soni $U_0 = 17, 8125$;
- zanjirli uzatmaning uzatish soni $U_2 = 2, 509$;
- GOST 2185-66 bo‘yicha silindrsimon egri tishli reduktorning uzatish soni $U_1 = 7, 1$.

Yuritma vallarining aylanish chastotasini aniqlash:

Elektrodvigatel vali (reduktor kirish vali) $n_1 = n_{дв} = 1425 \text{min}^{-1}$

Reduktorning kirish vali $n_2 = \frac{n_1}{U_1} = \frac{1425}{7,1} = 200, 704 \text{ min}^{-1}$

Yuritmaning chiqish vali $n_3 = \frac{n_2}{U_2} = \frac{200,704}{2,509} = 200,704 \text{мин}^{-1}$

Yuritma valida burovchi momentlarni aniqlash:

Yetakchi val (elektrodvigatel vali)$T_{дв} = 9,55 \cdot 10^3 \cdot \frac{P_р}{n_{дв}} = 9,55 \cdot 10^3 \cdot \frac{2,67}{1425} = 17,894 \text{Нм}$

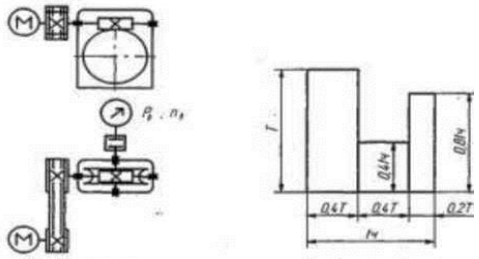
Reduktorning kirish vali $T_1 = T_{дв} \cdot \eta_м \cdot \eta_п = 17,894 \cdot 1 \cdot 0,995 = 17,805 \text{Нм}$

Reduktorning chiqish vali $T_2 = T_1 \cdot U_1 \cdot \eta_1 \cdot \eta_п = 17,805 \cdot 7,1 \cdot 0,96 \cdot 0,995 = 120,752 \text{Нм}$

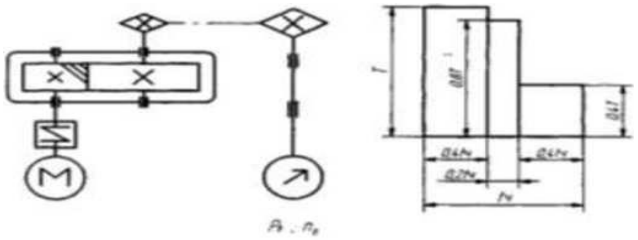
Yuritmaning chiqish vali $T_3 = T_2 \cdot U_2 \cdot \eta_2 \cdot \eta_п = 120,752 \cdot 2,509 \cdot 2,509 \cdot 0,9 \cdot 0,995 = 271,307 \text{Нм}$

2-masalani yechish namunasi. Zanjirli uzatmani kinematik hisoblash.

Chiqish vali quvvati, P_B, kVt - 5, 1 Chiqish vali aylanish chastotasi, n_v, min^{-1} - 55. Yuritmaning ishlatish muddati t_{ch}, ming.ch - 20, 0. *Yuritmaning umumiy FIK aniqlash.* Yuritmaning umumiy FIK quyidagi formula bo‘yicha aniqlanadi: $\eta_0 = \eta_1 \cdot \eta_2 \cdot \eta_n^m \cdot \eta_м$. Bu yerda: η_1 - egri tishli silindrsimon tishli uzatmaning FIK, η_2 - ochiq zanjirli uzatmaning FIK, $\eta_п$ - g‘ildirash podshipniklari juftligi FIK, m - g‘ildirash podshipniklari juftliklari soni $\eta_м$ – mufta FIK



Yuritma sxemasi Yuklama grafigi



Yuritma sxemasi Yuklama grafigi

Jadvaldan η_1 = 0, 70; η_2= 0, 95; $\eta_п$= 0, 99 ...0, 995; $\eta_м$= 0, 98 ... 1 ni olamiz.Yuritma sxemasi bo‘yicha m = 3. η_1= 0, 96; η_2= 0, 90; $\eta_п$= 0, 99; $\eta_м$ = 0, 99 deb olamiz, shunda η_0= 0, 70 • 0, 95 • 0, 99^2 • 0, 99 = 0, 645.Elektrodvigatelning hisoblash quvvatini aniqlash: $P_p = \frac{P_р}{\eta_0} = \frac{5,1}{0,645} = 7,907$ кВт.Elektrodvigatelning o‘rtacha kvadratik quvvatini aniqlash $P_{кв} = P_p\sqrt{\sum\left(\frac{T_i}{T_{max}}\right)} \cdot \frac{t_{чi}}{t_ч}$

bu yerda Ti - yuklanish siklogrammasining i-qismida yuklamaning xususiy qiymati; T_{chi} - yuklanish siklogrammasining i-qismida yuklama davomiyligining xususiy qiymati; T_{max} - davomiy yuklamaning eng katta qiymati; t_{ch} - uzatmaning ishlatish muddati.

$$P_{кв} = P_p \cdot \sqrt{\sum\left(\frac{1T}{T}\right)^2 \cdot \frac{0,4t_ч}{t_ч} + \left(\frac{0,4T}{T}\right)^2 \cdot \frac{0,4t_ч}{t_ч} + \left(\frac{0,8T}{T}\right)^2 \cdot \frac{0,2t_ч}{t_ч}}$$

$$P_{кв} = 7,907 \cdot \sqrt{(1)^2 \cdot 0,4 + (0,4)^2 \cdot 0,4 + (0,8)^2 \cdot 0,2} = 6,24кВт$$

1-jadvaldan GOST 19523-81 bo‘yicha 5A seriya uch fazali asinxron elektrodvigatelning nominal quvvatini R = 5, 5 kVt deb olamiz. Quyidagi shart bo‘yicha tanlangan elektrodvigatelni o‘ta yuklanishga tekshiramiz:$\frac{P_{кв}-P_{ном}}{P_{ном}} \cdot 100\% \leq 3\%.\frac{P_{кв}-P_{ном}}{P_{ном}} \cdot 100\% = \frac{6,246-5,5}{5,5} \cdot 100\% = 13,56\%$.O‘ta yuklanish joizlik chegarasidan 3% oshib ketgani uchun, keyingi katta nominal quvvatli R_{nom} = 7, 5 kVt elektrodvigatelni qabul qilamiz.*Elektrodvigatel tanlash va yuritmaning umumiy uzatishlari sonini pog‘onalar bo‘yicha ajratish.*Elektrodvigatelning qabul qilingan nominal quvvati bo‘yicha katalogdan valining aylanish chastotasi turli bo‘lgan GOST 28330-89 bo‘yicha AIR va 5A seriyali to‘rtta elektrodvigatel tanlanadi. Ular uchun qiyosiy hisoblashni amalga oshiramiz.Hisoblashlarni 2-jadvalga joylashtiramiz.

2-jadval.

Yuritmaning umumiy uzatishlari sonini pog‘onalar bo‘yicha ajratish

Aniqlanayotgan parametrlar	Elektrodvigatel turi R_{nom} = 7, 5kVt			
	AIRM112M2	AIRM132S4	AIRM132M6	5A160S8
1. Elektrodvigatelning aylanish chastotasi, $n_{кв}$ min $^{-1}$	2895	1440	960	725
2. Yuritmaning umumiy uzatishlari soni $U_0 = U_1U_2 = n_{dv}/n_v$	52, 6364	26, 18182	17, 45455	13, 18182
3. Zanjirli uzatma uchun tavsiya qilingan uzatish soni U_2	2, 75	2, 75	2, 75	2, 75
4. Reduktorning uzatish sonining hisoblangan qiymati U_1	19, 1405	9, 5207	6, 3471	4, 7934

5. GOST 2185-66 bo‘yicha reduktorning uzatish soni U_1	20	10	-	-
6. Zanjirli uzatmaning uzatish sonining hisoblangan qiymati $U_2 = U_0/U_1$	2, 632	2, 6182	-	-

Jadval tahlili natijalari va tavsiyalar asosida AIRM112M2 elektrodvigatel optimal tanlov degan xulosaga kelamiz. U holda:

- yuritmaning umumiy uzatishlar soni U_0=52, 6364;
- reduktorning uzatish soni U_1=20
- pona-tasmali uzatmaning uzatish soni U_2=2, 632

Yuritma vallarining aylanish chastotasini aniqlash:

Elektrodvigatel vali (etakchi shkiv): $n_1 = n_{дв}$ =2895min^{-1}

Reduktorning kirish vali $n_2 = \frac{n_1}{U_2} = \frac{2895}{2,632}$= 1099, 92 min^{-1}

Reduktorning chiqish vali $n_2 = \frac{n_2}{U_1} = \frac{1099,92}{20} = 55$ мин$^{-1}$

Yuritma valida burovchi momentlarni aniqlash:

Elektrodvigatel vali:$T_1 = 9,55 \cdot 10^3 \cdot \frac{P_р}{n_1} = 9,55 \cdot 10^3 \cdot \frac{7,907}{2895} = 26,084$Нм

Reduktorning kirish vali (chervyak vali):$T_2 = T_1 \cdot U_2 \cdot \eta_2 \cdot \eta_п = 26,084 \cdot 2,632 \cdot 0,95 \cdot 0,995 = 64,568$ Нм

Reduktorning chiqish vali (g‘ildirak vali):$T_3 = T_2 \cdot U_1 \cdot \eta_1 \cdot \eta_п = 64,568 \cdot 20 \cdot 0,70 \cdot 0,99 = 894,913$Нм

Foydalanilgan adabiyotlar

1. A.N.Abdullayev, Q.A.Sharipov ―Mashina detallari. Toshkent: AVTOMSAN. 2017 y.

2. Bibutov N.S-Amaliy mexanika- Toshkent: Yangi yo‘l poligraf servis”. 2008 y.