O’ZBEKISTON ALOQA VA AXBOROTLANISH AGENTLIGI
TOSHKENT AXBOROT TEXNOLOGIYALARI UNIVERSITETI

Elektr zanjirlar
nazariyasi kafedrasi

ELEKTR ZANJIRLARI NAZARIYASI

fanidan kurs ishini
bajarish uchun

Referat

Toshkent 2013

Zanjir chiqishlagi signal spektlarining variant topshiriqlari

1. $U_2(j\omega)=\frac{j\omega L\cdot 1}{(R+jL)j\omega}$

2. $U_2(j\omega)=\frac{j\omega L\cdot 1}{(j2\omega L+R)}$j

3. $U_2(j\omega)=\frac{(j\omega L+R)\cdot 1}{(j2\omega L+R)j\omega}$

4. $U_2(j\omega)=\frac{R\cdot 1}{(R+j2\omega L)(\alpha+j\omega)}$

5. $U_2(j\omega)=\frac{j\omega CR\cdot 1}{(j\omega CR+1)(\alpha+j\omega)}$

6. $U_2(j\omega)=\frac{j\omega CR\cdot 1}{(j\omega CR+2)(\alpha+j\omega)}$

7. $U_2(j\omega)=\frac{j\omega L\cdot 1}{(R+j2\omega L)j\omega}$

8. . $U_2(j\omega)=\frac{R\cdot 1}{(j\omega L+ZR)(\alpha+j\omega)}$

9. $U_2(j\omega)=\frac{(j\omega L+R)\cdot 1}{(j2\omega L+R)(\alpha+j\omega)}$

10. $U_2(j\omega)=\frac{j\omega CR\cdot 1}{(j2\omega CR+1)(\alpha+j\omega)}$

11. $U_2(j\omega)=\frac{(j\omega CR+1)\cdot 1}{(j\omega CK+2)j\omega}$

12. $U_2(j\omega)=\frac{R\cdot 1}{j\omega L+R}$

13. $U_2(j\omega)=\frac{j\omega L}{2R+j\omega L}$

14. $U_2(j\omega)=\frac{1\cdot 1}{(j\omega CR+1)j\omega}$

15. $U_2(j\omega)=\frac{(j\omega CR+1)\cdot 1}{j\omega CR+2}$

16. $U_2(j\omega)=\frac{1\cdot 1}{(j2\omega CR+1)j\omega}$

17. $U_2(j\omega)=\frac{1\cdot 1}{j2\omega CR+1}$

18. $U_2(j\omega)=\frac{(j\omega L+R)\cdot 1}{j\omega L+2R}$

19. $U_2(j\omega)=\frac{1\cdot 1}{(j\omega CR+2)j\omega}$

20. $U_2(j\omega)=\frac{(j\omega CR+1)\cdot 1}{j2\omega CR+1}$

21. $U_2(j\omega)=\frac{1\cdot 1}{(j2\omega CR+2)(\alpha+j\omega)}$

22. $U_2(j\omega)=\frac{j\omega L\cdot 1}{2R+j2\omega L}$

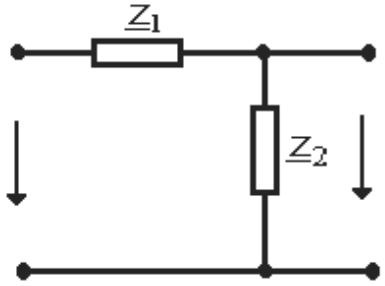
23. $U_2(j\omega)=\frac{R\cdot 1}{(j\omega L+3R)j\omega}$

24. $U_2(j\omega)=\frac{j\omega CR\cdot 1}{j3\omega CR+1}$

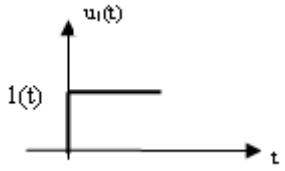
25. $U_2(j\omega)=\frac{j\omega LR\cdot 1}{(j3\omega LR+2R^2)(\alpha+j\omega)}$

2. SIGNALLAR SPEKTRLARNING TAXLIGI ASOSIDA ODDIY ZANJIRLARNI SINTEZ QILISh

2.1 2.1-rasmda keltirilgan Z_1 va Z_2 qarshiliklardan iborat bo'lgan oddiy zanjir (tirtqutblik) kirishiga 2.2-rasmda ko'rsatilgan uchta $U_1(t)$ signaldan birortasi beriladi.



2.1-rasm. Tekshirilayotgan zanjirining tuzilish sxemasi.



2.2-rasm. Kirishdagi signal variantlari .

2.2-rasmda ko'rsatilgan signallarga quydagi spektrlar mos keladi:

$$1(t) = V_1(j\omega) = \frac{1}{j\omega};$$
$$S(t) = V_1(j\omega) = 1;$$
$$e^{-dt} = V_1(j\omega) = \frac{1}{\alpha + j\omega}$$

Ko'rilayotgan zanjir chiqishida quydagi spektrga ega bo'lgan signal mavjud.

$$V_2(j\omega) = V_1(j\omega) \cdot H(j\omega)$$

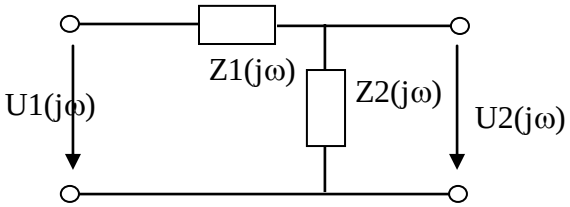
bu yerda H(jw)-zanjirning kompleks uzatish funktsiyasi.

Chiqishdagi signal spektri V_2 (jw) har bir talabaga uninig gurush jurnalidagi nomeriga (N) qarab alohida- alohida beriladi. R, L va C parametrlar 3-topshiriqdan olinadi.

2.2 Zanjir kirishiga qanaqa signal berilayotganini aniqlang: V_1(jw) va U_1(t).

2.3 Kompleks uzatish funktsiyasi H(jw)ni aniqlang.

2.4 Topilgan kompleks uzatish funktsiyasi H(jw)bo'yicha elektr zanjirni (elementlar orqali) oddiy kuchlanish bo'luvchisi ko'rinishida (bir nechta varianti bor) sintezlang.



2.3- rasm. Tekshirilayotgan sxema.

2.5.Sintezlangan zanjir kirishiga quydagi kuchlanishni bering:

$u_1(t) = 1 \cdot \sin \omega_c t$ bu yerda: $\omega_c = \frac{1}{\tau}$

τ-kirish qisqa tutashtirilganda zanjirning vaqt doimiysi.

Zanjir chiqishidagi $U_2(t)$ signalni aniqlang

2.6. Zanjir orqali signalning amalda buzilishsiz uzatiladigan (AChX o'zgarmas va FChX tig'ri chiziqli) chastotaviy oraliqni aniqlang.

Hisoblash uchun namuna

1)zanjir chiqishdagi berilgan signal spektri quydagi o'rinishga ega bo'lsin:

$$V_2(j\omega) = V_1(j\omega) \cdot H(j\omega) = \frac{1 \cdot (-1 + j\omega CR)}{(\alpha + j\omega) \cdot (2 + j\omega CR)}$$

Bu ifodani ko'paytuvchilarga ajratib kirishdagi signalni aniqlash mumkin:

$$V_1(j\omega) = \frac{1}{\alpha + j\omega} = e^{-\alpha t}$$

kompleks uzatish funktsiyasi

$$H(j\omega) = \frac{1 + j\omega CR}{2 + j\omega CR}.$$

H (jw)ning ifodasini Z_1(jw), Z_2(jw) kirinishiga keltiramiz

$$H(j\omega) = \frac{Z_2(j\omega)}{Z_1(j\omega) + Z_2(j\omega)}.$$

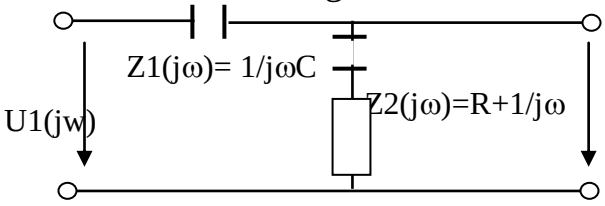
Bu holda ikkita variant bo'lishi mumkin:

<u>1-variant</u>. O'rin almashish sxemasini H(jw)ning surat va mahrajini R ga ko'paytirish yili bilan olish mumkin:

$$H(j\omega) = \frac{1 + j\omega CR}{1 + j\omega CR + 1} = \frac{R + j\omega CR^2}{2R + j\omega CR^2}.$$

$$Z_2(j\omega) = R + j\omega CR^2, \qquad Z_1(j\omega) = R.$$

bu 2.4-rasmda ko'rsatilgan o'rin almashish sxemasiga mos keladi.



$$Z_2(j\omega) = R_э + j\omega L_э = R + j\omega C \cdot R^2$$

2.4-rasm. O'rin almashish sxemasi.

2-variant H(jw)ning berilgan ifodasidagi surat va maxrajning har bir elementini jwC ga bo'lish yili bilan o'rin almmashish sxemasini hosil qilish mumkin:

$$H(j\omega)=\frac{1+j\omega CR}{2+j\omega CR}=\frac{\frac{1}{j\omega C}+R}{\frac{2}{j\omega C}+R}=\frac{\frac{1}{j\omega C}+R}{\frac{1}{j\omega C}+\frac{1}{j\omega C}+R}=\frac{Z_{2*}(j\omega)}{Z_1(j\omega)+Z_2(j\omega)};$$

U holda quyidagini olamiz:

$$Z_2(j\omega)=R+\frac{1}{j\omega C}$$

$$Z_1(j\omega)=\frac{1}{j\omega C}$$

O'rin almashish sxemasi quyidagi ko'rinishga ega (2.5-rasm.)

$$Z_1(j\omega)=\frac{1}{\omega C}$$

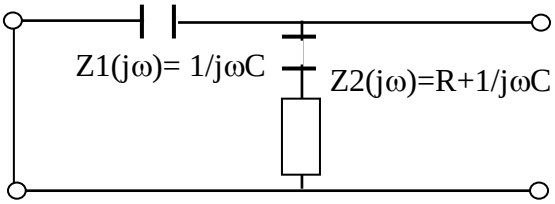
$$Z_2(j\omega)=R+\frac{1}{j\omega C}$$

2.5-rasm. O'rin almashish sxemasi (2-variant).

2)sintezlangan zanjir kirishiga (2-variant) kuchlanish beramiz:

$U_1(t)=1\cdot\sin\omega_1 t$, bu yerda $\omega_c=\frac{1}{\tau}$

Zanjir kirishini qisqa tutashtirib (2.6-rasm) τ ni aniqlaymiz:



$$\tau=\frac{CR}{2}$$

2.6-rasm. τ ni aniqlash uchun ekvivalent sxema.

(R, C yoki L parametrlar 3-topshiriqdan olinadi)

Masalan C= 4 mkf va R=5 Om bo'lsa, quyidagini olamiz:

$$\tau=\frac{4\cdot10^{-6}\cdot5}{2}=10\cdot10^{-6}c=1\cdot10^{-5}c,\qquad \omega_c=1\cdot10^{5}c^{-1},$$

yani

$u_1(t)=1\cdot\sin1\cdot10^5 t$,B.

$H(j\omega)=H(\omega)\cdot e^{j\varphi(\omega)}$ ekanini xisobga olib $H(w_c)$ va $\varphi(w_c)$ – larni hisoblaymiz:

$$H(j\omega_c) = \frac{1 + j\omega_c R \cdot C}{2 + j\omega_c \cdot RC} = H(\omega_c) \cdot e^{j\varphi(\omega_c)}$$

$$H(j\omega_c) = \frac{1 + j10^5 \cdot 5 \cdot 4 \cdot 10^{-6}}{2 + j10^5 \cdot 5 \cdot 4 \cdot 10^{-6}} = \frac{2{,}24 \cdot e^{j63{,}4^0}}{2{,}83 \cdot e^{j45^0}} = 0{,}79 \cdot e^{j18{,}4^0}$$

yani $H(\omega_c)$=O,79 $\varphi(\omega_c) = 18{,}40^0$

Kirishda ta'sir etayotgan $U_1(t)=1\cdot\sin\omega_c t$, signal uchun zanjir chiqishida quyidagini olamiz:

$$u_2(t) = H(\omega_c) \cdot \sin[\omega_c t + \varphi(\omega_c)] = 0{,}79 \cdot \sin(10^5 t + 18{,}4^0), B$$

3) qaysi chastotaviy oraliqda zanjir signali buzilishisiz uzatishni aniqlash maqsadida AChX va FChXni hisoblab grafiklarni chizamiz. $w=w_c$ chastotadan tashqari hech bo'lmaganda yana oltita nuqtani hisoblaymiz, masalan w=0: 0,I w_c ; 0 ,5w_c; 2w_c ; 5 w_c ;10 w_c .

Hisobni quyidagi formula bo'yicha olib boramiz

$$H(j\omega_c) = \frac{1 + j\omega CR}{2 + j\omega CR}$$

Biz ko'rgan misolda (RS) =5.4.10^{-6} =2.10^{-5}s,
Hisob natijalarini 2.1Jadvalga kiritamiz.

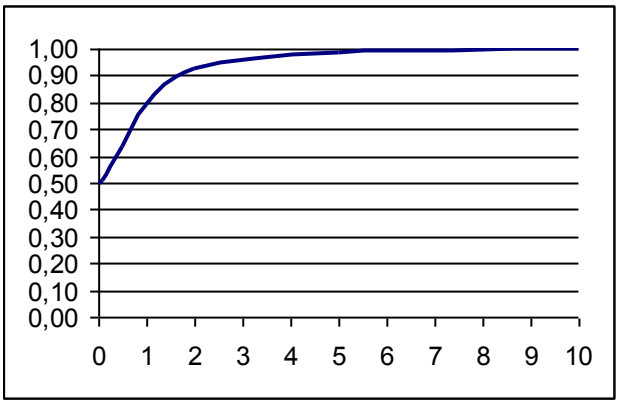
2.1-jadval

Kuchlanish bo'yicha uzatish funktsiyasining amplituda-chastotaviy va fazochastotaviy xarakteristikalarini hisoblash natijalari

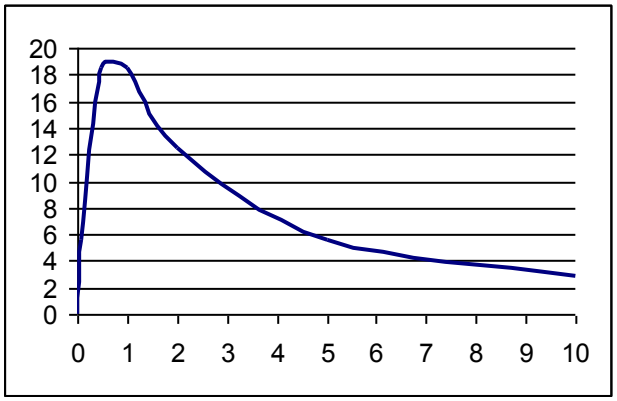
ω, c^{-1}	0	$0{,}1.10^5$	$0{,}5.10^5$	1.10^5	2.10^5	5.10^5	10.10^5
ω/ω_c	0	0,1	0,5	1	2	5	10
$H(\omega)$	0,5	0,507	0,634	0,79	0,922	0,98	0,995
$\varphi(\omega)$град	0	5,60	18,44	18,43	12,52	5,60	2,85

Hisob natijalari Bo'yicha zanjir uzatish funktsiyasi (2.7 va 2.8- rasmlar) AChX va FChX larni chizamiz.

Zanjirning AChX va FChX sini tahlil qilib, quyidagi xulosaga kelish mumkin: 5 W_c dan 10 W_c gacha bo'lgan chastotaviy oraliqda zanjir signalni amalda buzilishsiz uzatadi, deb hisoblash mumkin.



2.7- rasm Kuchlanish bo'yicha uzatish funktsiyasining amplituda-chastotaviy xarakteristikasi.



2.8 Kuchlanish bo'yicha uzatish funktsiyasining fazo-chastotaviy xarakteristikasi.