22-ma`ruza. Nosinusoidal elektr manbaiga ulangan elektr zanjirlarni xisoblash

Reja

1. Uch fazali tok zanjirlaridagi yuqori garmonik tashkil etuvchilar.
2. Nosinusoidal simmetrik egri chiziqlarning garmonika tarkiblari.

1. Uch fazali tok zanjirlaridagi yuqori garmonik tashkil etuvchilar.

Eng mukammal konstruksiyali uch fazali generatorlar xam ideal shakldagi sinusoidal e.yu.k. xosil qilmaydi. Agar zanjirda xarakteris-tikalari chizigiy bo`lmagan elementlar bo`lsa, ist'emol qilinaetgan tok tarkibida yuqori garmoniklar yanada zo`rayadi. Xarakteristikalari chizigiy bo`lmagan elementlar nosinusoidal tebranishlarning manbagi ekanligi qiyinroq aloxida ko`rsatib o`tiladi.

Uch fazali zanjirlar simmetrik bo`lgani tufayli, uchchala fazada xam garmoniklarning amplitudaviy va chastotaviy tarkibi bir xil bo`ladi. Fazalardagi e.yu.k.larning egri chiziqlari o`zaro $\frac{2\pi}{3}$ burchakka yoki nosinusoidal funksiya T davrining uchdan biriga siltigan. Davr T bir vaqtda birinchi garmonikaning xam davri bo`lgani uchun K-tartibdagi yuqori garmonikalar qo`shni ikkala fazada K $\frac{2\pi}{3}$ qadar (yoki vaqt jixatidan kT\3. Shunday qilib, k-va q- garmonikalar uchun generatorning ikkita qo`shni fazalaridagi faza siljishi burchaklari teng bo`lmaydi. Masalan, A fazaning e.yu.k.:

$$e_A = E_{1m}\mathrm{Sin}\omega t + E_{3m}\mathrm{Sin}(3\omega t + \psi_3) + E_{5m}\mathrm{Sin}(5\omega t + \psi_5) + E_{7m}\mathrm{Sin}(7\omega t + \psi_7)$$

<u>Simmetrik uch fazali sistemalarda juft garmonikalar va o`zgarmas tashkil etuvchilar bo`lmaydi</u>

e_V ning e.yu.k. fazasi ye$_{A\,din}$ 2p\3 qadar orqada, ye$_S$ ning esa 2p\3 burchakka oldin kelishini bilgach quyidagini yozamiz:

$$e_B = E_{1m}\,\mathrm{Sin}(\omega t - \frac{2\pi}{3}) + E_{3m}\mathrm{Sin}(3\omega t + \psi_3 - 3\frac{2\pi}{3}) + E_{5m}\mathrm{Sin}(5\omega t + \psi_5 - 5\frac{2\pi}{3}) +$$

$$+ E_{7m}\mathrm{Sin}(7\omega t + \psi_7 - 7\frac{2\pi}{3}) = E_{1m}\mathrm{Sin}(\omega t - \frac{2\pi}{3}) + E_{3m}\mathrm{Sin}(3\omega t + \psi_3) +$$

$$E_{5m}\mathrm{Sin}(5\omega t + \psi_5 + \frac{2\pi}{3}) + E_{7m}\mathrm{Sin}(7\omega t + \psi_7 - \frac{2\pi}{3}).$$

$$e_C = E_{1m}\mathrm{Sin}(\omega t + \frac{2\pi}{3}) + E_{3m}\mathrm{Sin}(3\omega t + \psi_3) + E_{5m}\mathrm{Sin}(5\omega t + \psi_5 - \frac{2\pi}{3}) +$$

$$+ E_{7m}\mathrm{Sin}(7\omega t + \psi_7 + \frac{2\pi}{3}).$$

Uch fazali generatorning faza chulg`amlari yulduz usulida ulanganda faza kuchlanishning effektiv qiymati:

$$U\phi = \sqrt{U_1^2 + U_3^2 + U_5^2 + U_7^2 + U_9^2 + U_{11}^2 + \ldots}$$

Liniya kuchlanishining effektiv qiymati:

$$U_{Л} = \sqrt{3}\sqrt{U_1^2 + 0 + U_5^2 + U_7^2 + 0 + U_{11}^2 + ..}$$

$$Ul = \sqrt{3}U\phi$$

$$U_{ф.ист} = \sqrt{U_1^2 + U_5^2 + U_7^2 + U_{11}^2 + \ldots}$$

Generator bilan nagruzkaning 0 va0^{I} nuqtalari orasida:

$$U_{00^1} = \sqrt{U_3^2 + U_9^2 + U_{15}^2 + \ldots}$$

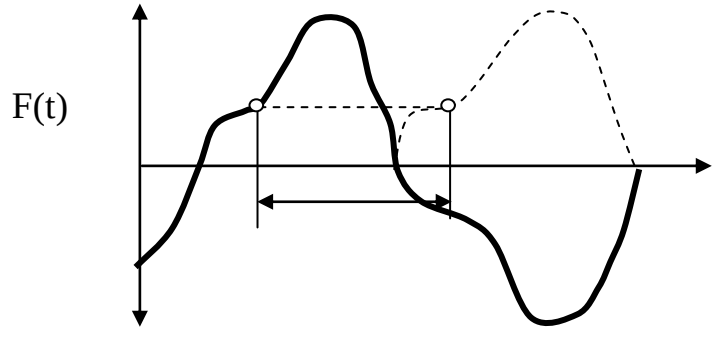
$$I_{ф} = I_{л} = \sqrt{I_1^2 + I_3^2 + I_5^2 + I_7^2 + I_9^2 + \ldots}$$

Yig`indi tokning effektiv qiymati:

$$I_{и} = 3\sqrt{I_3^2 + I_9^2 + I_{15}^2 + \ldots}$$

2. Nosinusoidal simmetrik egri chiziqlarning garmonika tarkiblari.

Amalda uchraydigan davriy nosinusoidal o`zgaruvchan elektr mikdorlari ega bo`lgan egri chiziqlar bilan ifodalanadi. Agar f(t) nosinusoidal davriy o`zgaruvchan funksiya f(t) = -f(t+T/2) shartni qanoatlantirsa, uning egri chizigi abssissalar o`qiga nisbatan simmetrik xisoblanadi.



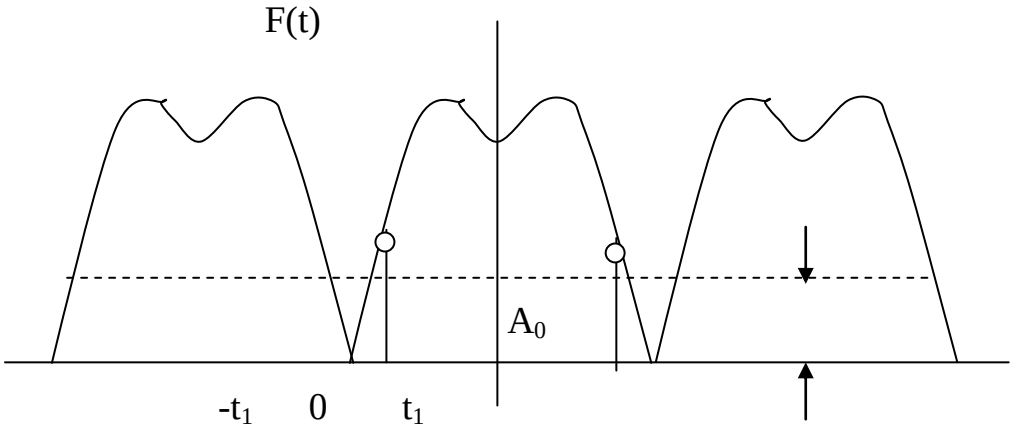
Fure qatoriga yeyganda egri chiziqning garmonikalari tarkibida o`zgarmas tashkil etuvchilar va juft garmonikalar bo`lmaydi,

$$f(t) = A_1^{'}\mathrm{Sin}\omega t + A_1^{''}\mathrm{Cos}\omega t + A_3^{'}\mathrm{Sin}3\omega t + A_3^{''}\mathrm{Cos}3\omega t + ...$$

Agar f(t) davriy nosinusoidal o`zgaruvchan funksiya

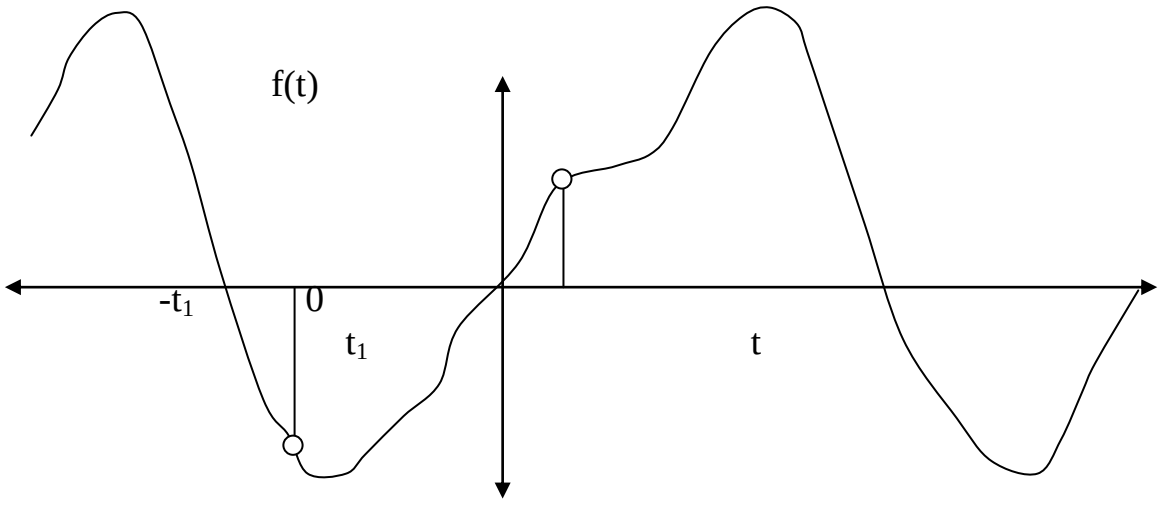
$$f(t) = f(-t)$$

shartni qanoatlantirsa, uning egri chizig`i ordinatalar o`qiga nisbatan simmetrik xisoblanadi.



$$f(t) = Ao + A_1^{11}\cos\omega t + A_2^{11}\cos 2\omega t + A_3^{11}\cos 3\omega t + ..$$

Agar f(t) nosinusoidal davriy funksiya f(t) =-f(-t) shartni qanoatlantirsa, uning egri chizigi koordinatalar sistemasining markaziy nuqtasiga nisbatan simmetrik xisoblanadi.



Fure qatoriga yeyish formulasida simmetriya shartlarini faqat uning sinusi tashkil etuvchilari qanoatlantiradi.

$$f(t) = A_1' Sin\omega t + A_2' Sin2\omega t + A_3' Sin3\omega t + ...$$

Sinov savollari.

1. Elektr zanjiridagi rezonans qodisasiga ta’rif bering.
2. Uch fazali yulduz usulida ulanganda faza kuchlanishining effektiv qiymati qanday ifodalanadi?
3. Davriy nosinusoidal funksiyalarning qanday simmetrik alomatlari mavjud?