



## CREATING AN COMPUTER PROGRAM FOR CALCULATIONS USED TO CONVERT ALTERNATING VOLTAGE TO CONSTANT VOLTAGE IN THE ELECTRICAL NETWORK BY MEANS OF TWO HALF-CYCLE RECTIFIER DIODES

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### ARTICLE INFO

Received: 17<sup>th</sup> May 2024

Accepted: 24<sup>th</sup> May 2024

Online: 25<sup>th</sup> May 2024

### KEY WORDS

Diode, valve, frequency  
pulsation, half-cycle, rectifier, P-  
N switching, High-frequency  
rectifier diodes, Low-frequency  
rectifier diodes, energy, source.

### ABSTRACT

*The created computer program is used to calculate two half-period correction processes. Using the formulas and circuits required to convert AC to DC voltage using two half-cycle rectifier diodes, using this program to design power supply devices will save time and help to make accurate calculations. To reduce the value of the alternating voltage of the electric network and convert it into direct voltage, a low-frequency transformer is used, a semiconductor diode is connected to its output. To perform these tasks, the article contains diagrams showing the connection of diodes to the transformer and the calculation of the necessary properties, depending on the application, the corresponding formulas are written.*

## СОЗДАНИЕ ПРОГРАММЫ ЭВМ ДЛЯ РАСЧЕТОВ ПРЕОБРАЗОВАНИЯ ПЕРЕМЕННОГО НАПРЯЖЕНИЯ В ПОСТОЯННОЕ В ЭЛЕКТРИЧЕСКОЙ СЕТИ С ПОМОЩЬЮ ДВУХ ПОЛУПЕРИОДНЫХ ВЫПРЯМИТЕЛЬНЫХ ДИОДОВ

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### ARTICLE INFO

Received: 17<sup>th</sup> May 2024

Accepted: 24<sup>th</sup> May 2024

Online: 25<sup>th</sup> May 2024

### KEY WORDS

Диод, вентиль, пульсация  
частоты, полупериод,  
выпрямитель, P-N  
переключение,  
высокочастотные  
выпрямительные диоды,

### ABSTRACT

*Созданная программа ЭВМ используется для расчета двух полупериодных процессов коррекции. Использование формул и схем, необходимых для преобразования переменного напряжения в постоянное с помощью двух полупериодных выпрямительных диодов, использование данной программы для проектирования устройств электропитания сэкономит время и поможет провести точные расчеты. Для уменьшения величины*



низкочастотные  
выпрямительные диоды,  
энергия, источник.

переменного напряжения электрической сети и преобразования его в постоянное напряжение используется низкочастотный трансформатор, к его выходу подключается полупроводниковый диод. Для выполнения этих задач в статье приведены схемы, показывающие подключение диодов к трансформатору и расчет необходимых свойств, в зависимости от применения написаны соответствующие формулы.

## IKKITA YARIM DAVRLI TO'G'RILAGICH DIODLAR ORQALI ELEKTR TARMOG'IDAGI O'ZGARUVCHAN KUCHLANISHNI O'ZGARMAS KUCHLANISHGA O'ZGARTIRISHDA FOYDALANILADIGAN HISOBLASHLAR UCHUN EHM DASTURINI YARATISH

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### ARTICLE INFO

Received: 17<sup>th</sup> May 2024

Accepted: 24<sup>th</sup> May 2024

Online: 25<sup>th</sup> May 2024

### KEY WORDS

Diod, ventil, chastota pulsatsiya, yarim davrli, to'g'rilagich, P-N o'tkazish, yuqori chastotali to'g'rilagich diodlar, past chastotali to'g'rilagich diodlar, energiya, manbaa.

### ABSTRACT

Ikkita yarim davrli to'g'rilashni bajaruvchi diod yordamida o'zgaruvchan kuchlanishni o'zgarmasga aylantirish uchun zarur bo'lgan formulalar va chizmalardan foydalanib, elektr manbaa ta'minot qurilmalarini ishlab chiqishda ushbu dasturdan foydalanish vaqtni tejashga va bexato hisoblarlarni bajarishda samara beradi. Elektr tarmog'ining o'zgaruvchan kuchlanish qiymatini pasaytirib o'zgarmas kuchlanishga aylantirishda past chastotali transformator qo'llanilib uning chiqishiga yarim o'rkazgich diod ulanadi. Ushbu ishlarni bajarish uchun maqolada diodlarni transformatorga ulashni ko'rsatuvchi chizmalar berilgan va zaruriy xossalarni hisoblash, qo'llanilishiga qarab tegishli formulalar yozilgan. Yaratilgan EHM dasturi ikkita yarim davrli to'g'rilash jarayonini hisoblashda foydalaniladi.

Zaryadlarni bir tomonga o'tkazuvchi element diod deyiladi. Diod P-N o'tkazish asosida ishlagani uchun musbat va manfiy ketmaketlikda kelgan zaryadlarning musbatini o'tkazib manfiysini o'tkazmagani uchun yarim o'tkazgich deyiladi. Yarim o'tkazgichli diodlar ma'lumotnomalarda radioelektron apparaturalarda qo'llanilish sohalari yoki vazifasiga ko'ra sinflanadilar.

### To'g'rilagich diodlar



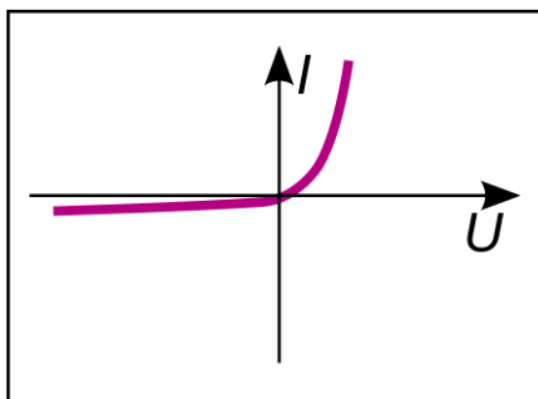
To'g'rilagich diodlar kuchlanish manbai o'zgaruvchan kuchlanishini o'zgarasga o'g'irishda qo'llaniladi. To'g'rilovchi diodlarning asosiy xossasi– bir tomonlama o'tkazuvchanlik bo'lib, uning mavjudligi to'g'rilash effekti bilan aniqlanadi.

To'g'rilovchi diodlarning ishlatilish chastota diapazoni juda keng. Shu sababli ular ishchi chastota diapazoni bo'yicha sinflanadilar.

**Past chastotali to'g'rilagich diodlar (PCh diodlar)** sanoat chastotasidagi (50 Gs) o'zgaruvchan tokni o'zgarasga o'g'irishda qo'llaniladi. PCH diodlariga qo'yiladigan asosiy talab – bu katta qiymatga ega bo'lgan to'g'rilangan toklar olish. To'g'rilovchi diodlar odatda 0,3 A gacha, 0,3 A dan 10 A gacha va 10 A dan yuqori bo'lgan to'g'rilangan toklarga mo'ljallangan kichik, o'rta va katta quvvatli diodlarga bo'linadi. PCH diodlari katta r-n o'tish bilan xarakterlanadilar.

**Yuqori chastotali to'g'rilagich diodlar (YUCH diodlar)** o'n va yuz megagers chastotagacha bo'lgan signallarni nochiziqli elektr o'zgartirishga mo'ljallangan. YUCH diodlari yuqori chastota signallari detektorlari, aralashtirgichlar, chastota o'zgartirgich chizmalar va boshqalarda qo'llaniladi. Yuqori chastota diodlari kichik inersiyaga ega, chunki kichik yuzaga ega bo'lgan nuqtaviy r-n o'tishga ega va shu sababli ularning to'siq sig'imi pikofaradning bir qismini tashkil etadi.

**Ventil** (lot. ventilo — puflayman esaman) — bir tomonlama o'tkazuvchanlik xossasiga ega bo'lgan elektr asboblarning umumiy nomi. To'g'ri tok yo'nalishida kam qarshilikka, teskari tok yo'nalishida esa katta qarshilikka ega bo'ladi. Boshqacha aytganda, V. tokni bir ("to'g'ri") yo'nalishda yaxshi, ikkinchi ("teskari") yo'nalishda yomon o'tkazadi. Bu xossasi tufayli V. tokni to'g'rilash qurilmasi sifatida keng qo'llaniladi. V. lik xususiyati metall va elektrolit (elektrolitik V.), metall va gaz (ion V.), vakuumdagi metall va yarimo'tkazgich yoki har xil tarkibli ikki yarimo'tkazgich (yarimo'tkazgich V.) chegarasida namoyon bo'lishi mumkin. V. larning boshqariladigan va boshqarilmaydigan xillari bo'ladi. V. to'g'rilanayotgan tok quvvati ( $V_t$ , kVt), kuchi ( $a$ ), ish kuchlanishi ( $V$ , kV), kuchlanishning to'g'ri yo'nalishda pasayishi, teskari yo'nalishda teshib o'tish kuchlanishi va b. ko'rsatkichlar bilan ifodalanadi. V. radiopriyomniklar, kuchli energetika qurilmalari, elektr uzatish liniyalari, avtomatika, elektronika, hisoblash texnikasi, o'ta yuqori chastotalar texnikasi va radioqurilmalarda detektor, tiristor va to'g'rilagich sifatida ishlatiladi. Umuman, diodlarning hamma turlari, elektrolitik to'g'rilagichlar va mantikiy elementlar ham V. jumlasiga kiradi; 2) suyuqlik, gaz yoki bug' oqimi yo'lini ochib yuborish yoki berkitib qo'yish, bu oqim miqsorini ko'paytirish yoki kamaytirish uchun mo'ljallangan qurilma. Oddiy V. — vodoprovod jo'mragi. Uni quvur (truba) ga birlashtirish uchun ikki uchiga ichki rezba kesiladi. Katta V. lar korpusining ikki yonida flanes bo'ladi. V. maxovigi (bandi) qo'lda buraladi. Quvurdan oqayotgan suyuqlik yoki gaz bosimi o'zgarganda ishga tushadigan elektr yoki gidravlik dvigatel yordamida V.ni avtomatik tarzda boshqarib turish ham mumkin. V. vodoprovod, gaz kuvurlari, sanoat truboprovodlari, sanitariyatexnika qurilmalarida ishlatiladi; 3) musiqa — valtorna, truba kabi mis puflama musiqa cholg'ulari stvoli uzunligini uzaytirish uchun mo'ljallangan mexanizm. Puflama musiqa asbobida V. sifatida aylanma klapan- baraban ishlatiladi. Ijrochi V. dan foydalanib turlicha balandlikdagi tabiiy tovush qatorlarini hosil qiladi.

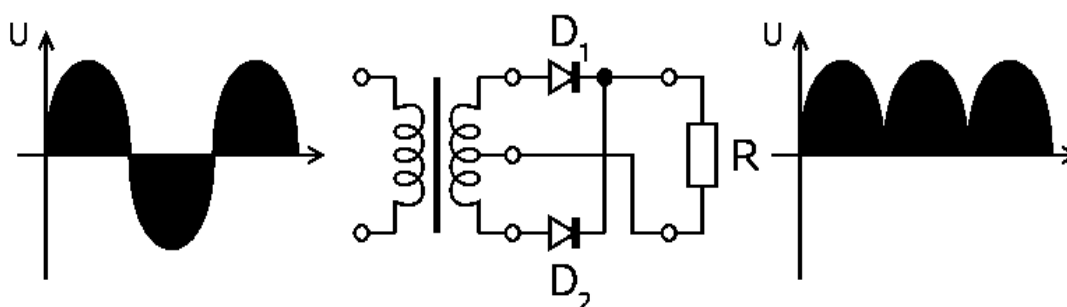


1.1 – rasm. Diodning Volt amper tavsifi

Bir fazali kuchlanish uchun diodlarini to'g'rilagich sifatida qo'llashning uch turining taxlili:

### Ikkita yarim davrli to'g'rilagich

Uchta chiqish uchlariga ega bo'lgan va o'rtasiga nisbatan birinchi va oxirgi uchlaridagi kuchlanishi o'zaro teng bo'lgan transformatorga ikkita diodlarni ulash orqali, ikkita yarim davrli to'g'rilagichni hosil qilinib, ko'p tok iste'mol qiluvchi qurilmalarni elektr energiyasi bilan ta'minlash mumkin.



1.4 – rasm. Ikkita diodli energiya manba ta'minoti qurilmasida kuch diodi sifatida ulanishi.

To'g'rilangan tokning rezistorli yuklamadagi tok kuchini tashkil etuvchisi ( $I_{T.o'r}$ ) shu formula bilan aniqlanadi:  $I_{T.o'r} = 2/\pi * I_{2a} = 0.636 * I_{2a}$

To'g'rilangan kuchlanishning o'rtacha qiymati:

$$U_{T.o'r} = 2 * \sqrt{2} * U_2 / \pi = 0.9 * U_2$$

Ventildan o'tayotgan tok amplitudasi:  $I_{2a} = I / 0.636 = 1.57 * I_{T.o'r}$

Diodlarga kelgan o'zgaruvchan kuchlanish va tokning ta'sir etuvchisi:  $U_2 = 1.11 * U_{T.o'r}$ ;  
 $I_2 = 0.785 * I_{T.o'r}$

$$I_{T.o'r} = I_2 / 0.785;$$

$U_{2a}$  – diodga kelgan kuchlanish amplitudasi:  $U_{2a} = \sqrt{2} * U_2$ ;

Ventildagi teskari kuchkanish kattaligi:  $U_{tes} = 2 * U_{2a} = 3.14 * U_{T.o'r}$

Pulsatsiya chastotasini aniqlash:  $f_n = 2 * f_t$  Tarmoq chastotasi:  $f_t$

Koeffisient pulsatsiya  $K_n = 0.67$

Ushbu nazariy amaliy manbaalarga tayanib zamonaviy EHM uchun dastur yaratish orqali yoqoridagi hisoblash jarayonlarini ixchamlashtirish, aniqligini oshirish va xatoliklarni kamaytirishga erishish mumkin. EHM dasturini yaratish uchun Delphi-7 dasturlash muhitidan



foylanaib yuqoridagi tegishli formulalar uchun EHMning maxsus kodlari qollaniladi. Yaratilgan dasturning kodlari quyida yoritiladi va natija rasmi keltiriladi.

unit Unit1;

interface

uses

Windows, Messages, SysUtils, Variants, Classes, Graphics, Controls, Forms,  
Dialogs, StdCtrls, dxGDIPlusClasses, ExtCtrls, ComCtrls;

type

TForm1 = class(TForm)

Image2: TImage; ButtonChiqish: TButton; Image7: TImage; Image8: TImage;

Edit25a: TEdit; Edit25b: TEdit; Label19: TLabel; Image14: TImage;

Image16: TImage; Label22: TLabel; Edit26a: TEdit; Edit26b: TEdit;

Label23: TLabel; Label24: TLabel; Edit27a: TEdit; Edit27b: TEdit; Label25: TLabel;

Indikator: TLabel; RadioButton25: TRadioButton; RadioButton26: TRadioButton;

RadioButton27: TRadioButton; Label27: TLabel; Image17: TImage; Edit21a: TEdit;

Edit21b: TEdit; Label28: TLabel; Image18: TImage; Image19: TImage;

Image20: TImage; Label29: TLabel; Edit22a: TEdit; Edit22b: TEdit; Label30:

TLabel;

Label31: TLabel; Edit23a: TEdit; Edit23b: TEdit; Label32: TLabel; Label33: TLabel;

Edit24a: TEdit; Edit24b: TEdit; Label34: TLabel; RadioButton21: TRadioButton;

RadioButton22: TRadioButton; RadioButton23: TRadioButton;

RadioButton24: TRadioButton; Image21: TImage; Label35: TLabel; Edit28a: TEdit;

Edit28b: TEdit; Label36: TLabel; RadioButton28: TRadioButton; Label45: TLabel;

Timer1: TTimer; Panel2: TPanel; Button1: TButton; Label1: TLabel; Label2:

TLabel;

Image1: TImage; Label3: TLabel; Label4: TLabel; Edit29a: TEdit; Edit29b: TEdit;

RadioButton29: TRadioButton;

procedure ButtonChiqishClick(Sender: TObject);

procedure Timer1Timer(Sender: TObject);

procedure Button1Click(Sender: TObject);

private

{ Private declarations }

public

{ Public declarations }

end;

var

Form1: TForm1;

Ut: Real;



U2:Real;  
implementation

{ \$R \*.dfm }

```
procedure TForm1.ButtonChiqishClick(Sender: TObject);
begin
Close;
end;
```

```
procedure TForm1.Timer1Timer(Sender: TObject);
begin
Indikator.Color:=clLime;
Timer1.Enabled:=false;
end;
```

```
procedure TForm1.Button1Click(Sender: TObject);
begin
```

```
if RadioButton21.Checked=True then
begin
Indikator.Caption:='1-1'; Indikator.Color:=clBtnFace; Timer1.Enabled:=true;
U2:=StrToFloat(Edit21b.Text); Edit21a.Text:=FloatToStr(U2*0.636);
end;
```

```
if RadioButton22.Checked=True then
begin
Indikator.Caption:='1-2'; Indikator.Color:=clBtnFace; Timer1.Enabled:=true;
U2:=StrToFloat(Edit22b.Text); Edit22a.Text:=FloatToStr(U2*0.9);
end;
```

```
if RadioButton23.Checked=True then
begin
Indikator.Caption:='1-3'; Indikator.Color:=clBtnFace; Timer1.Enabled:=true;
U2:=StrToFloat(Edit23b.Text); Edit23a.Text:=FloatToStr(U2*1.57);
end;
```

```
if RadioButton24.Checked=True then
begin
Indikator.Caption:='1-4'; Indikator.Color:=clBtnFace; Timer1.Enabled:=true;
U2:=StrToFloat(Edit24b.Text); Edit24a.Text:=FloatToStr(U2*1.11);
end;
```



```
if RadioButton25.Checked=True then
```

```
begin
```

```
Indikator.Caption:='1-5'; Indikator.Color:=clBtnFace; Timer1.Enabled:=true;
```

```
U2:=StrToFloat(Edit25b.Text); Edit25a.Text:=FloatToStr(U2*0.785);
```

```
end;
```

```
if RadioButton26.Checked=True then
```

```
begin
```

```
Indikator.Caption:='1-6'; Indikator.Color:=clBtnFace; Timer1.Enabled:=true;
```

```
U2:=StrToFloat(Edit26b.Text); Edit26a.Text:=FloatToStr(U2/0.785);
```

```
end;
```

```
if RadioButton27.Checked=True then
```

```
begin
```

```
Indikator.Caption:='1-7'; Indikator.Color:=clBtnFace; Timer1.Enabled:=true;
```

```
U2:=StrToFloat(Edit27b.Text); Edit27a.Text:=FloatToStr(U2*3.14);
```

```
end;
```

```
if RadioButton28.Checked=True then
```

```
begin
```

```
Indikator.Caption:='1-8'; Indikator.Color:=clBtnFace; Timer1.Enabled:=true;
```

```
U2:=StrToFloat(Edit28b.Text); Edit28a.Text:=FloatToStr(U2*2);
```

```
end;
```

```
if RadioButton29.Checked=True then
```

```
begin
```

```
Indikator.Caption:='1-9'; Indikator.Color:=clBtnFace; Timer1.Enabled:=true;
```

```
U2:=StrToFloat(Edit29b.Text); Edit29a.Text:=FloatToStr(U2*1.41);
```

```
end;
```

```
end;
```

```
end.
```

**Ikkita diod yordamida to'g'rilagichni hisoblash uchun EHM dasturi**

To'g'rilangan tokning, rezistorli yuklamadagi tok kuchini tashkil etuvchisi ( $I_{T.o'r}$ ) shu formula bilan aniqlanadi:  $I_{T.o'r} = 2/\pi * I_{2a} = 0.636 * I_{2a}$ ;  $I_{T.o'r} = 0.636 * I_{2a}$

To'g'rilangan kuchlanishning o'rtacha qiymati:  $U_{T.o'r} = 2 * \sqrt{2} * U_2 / \pi = 0.9 * U_2$

Ventildan o'tayotgan tok amplitudasi:  $I_{2a} = I / 0.636 = 1.57 * I_{T.o'r}$ ;  $I_{2a} = 1.57 * I_{T.o'r}$

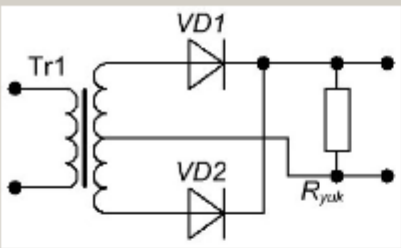
Diodlarga kelgan o'zgaruvchan kuchlanish va tokning ta'sir etuvchisi:  
 $U_2 = 1.11 * U_{T.o'r}$ ;  $I_2 = 0.785 * I_{T.o'r}$   
 $I_{T.o'r} = I_2 / 0.785$ ;

$U_{2a}$  – diodga kelgan kuchlanish amplitudasi:  $U_{2a} = \sqrt{2} * U_2$ ;

Ventildagi teskari kuchlanish kattaligi:  $U_{tes} = 2 * U_{2a} = 3.14 * U_{T.o'r}$

Pulsatsiya chastotasini aniqlash:  $f_n = 2 * f_t$  Tarmoq chastotasi:  $f_t$

Koeffitsient pulsatsiya  $K_n = 0.67$



**1-1**

0 = 0.636 \* 1 A  
 $I_{T.o'r} = 0.636 * I_{2a}$  1-1

0 = 0.9 \* 1 Volt  
 $U_{T.o'r} = 0.9 * U_2$  1-2

0 = 1.57 \* 1 A  
 $I_{2a} = 1.57 * I_{T.o'r}$  1-3

0 = 1.11 \* 1 Volt  
 $U_2 = 1.11 * U_{T.o'r}$  1-4

0 = 1 Volt  
 $I_2 = 0.785 * I_{T.o'r}$  1-5

0 = 1 / 0.785 A  
 $I_{T.o'r} = I_2 / 0.785$  1-6

0 = 3.14 \* 1 Volt  
 $U_{tes} = 3.14 * U_{T.o'r}$  1-7

0 = 2 \* 1 Hz  
 $f_n = 2 * f_t$  1-8

0 = 1.41 \* 1 A  
 $U_{2a} = \sqrt{2} * U_2$  1-9

Hisoblash

Chiqish

Muallif  
 Saydulla Abduraxmonovich Jurayev

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