PROIECT EI2

Nicolae Danut Popa

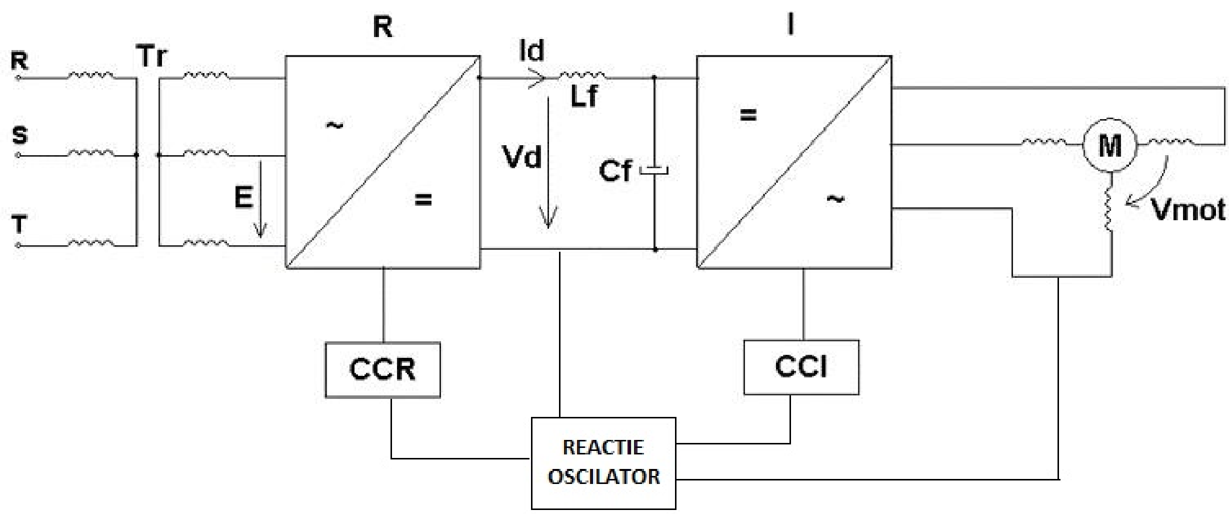
Grupa 5402

2017-2018

Enunt: sa se realizeze proiectarea unui convertizor static de frecventa cu urmatoarele date:

- V_{motor} = 390 V
- Sm = 10 kVA
- Δf = {$f_{min;}$ f_{max}} = {5; 79} Hz
- Tip redresor: RPMT – redresor trifazat cu punct median comandat
- E = 310 V

Schema bloc:



Etapa 1:

$\check{V}$ = valoarea amplitudinii tensiunii de faza

V_{LL} = valoarea efectiva a tensiunii de linie

$$\check{V} = 2 \cdot \frac{1}{T}\left[\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} \frac{Vd}{3}\cos(wt)\,dwt + \int_{\frac{-\pi}{6}}^{\frac{\pi}{6}} \frac{Vd}{3}\cos(wt)\,dwt\right]$$

$$\check{V} = \frac{2Vd}{3\pi}\left[\sin(wt)\,dt\,\Big|_{\frac{-\pi}{2}}^{\frac{\pi}{2}} + \sin(wt)\,dt\,\Big|_{\frac{-\pi}{6}}^{\frac{\pi}{6}}\right]$$

$$\check{V} = \frac{2Vd}{3\pi}\left[\left(\sin\left(\frac{\pi}{2}\right) - sin\left(-\frac{\pi}{2}\right)\right) + \left(\sin\left(\frac{\pi}{6}\right) - sin\left(-\frac{\pi}{6}\right)\right)\right]$$

$$\check{V} = Vd \cdot a$$

$$a = \frac{2}{\pi} \cong 0.636$$

$$V_{LL} = \frac{\sqrt{3}}{\sqrt{2}} \cdot Vd \cdot a \Rightarrow Vd = \frac{\sqrt{2}}{\sqrt{3}a} V_{LL}$$

$$V_{LL} = V_{motor} = 390V$$

$$Vd = \frac{\sqrt{2} \cdot 390}{\sqrt{3} \cdot 0.636} = \frac{551.543}{1.101} = 500.947 \cong 501V$$

Raportul de transformare al transformatorului Tr este n = 1.7 =>

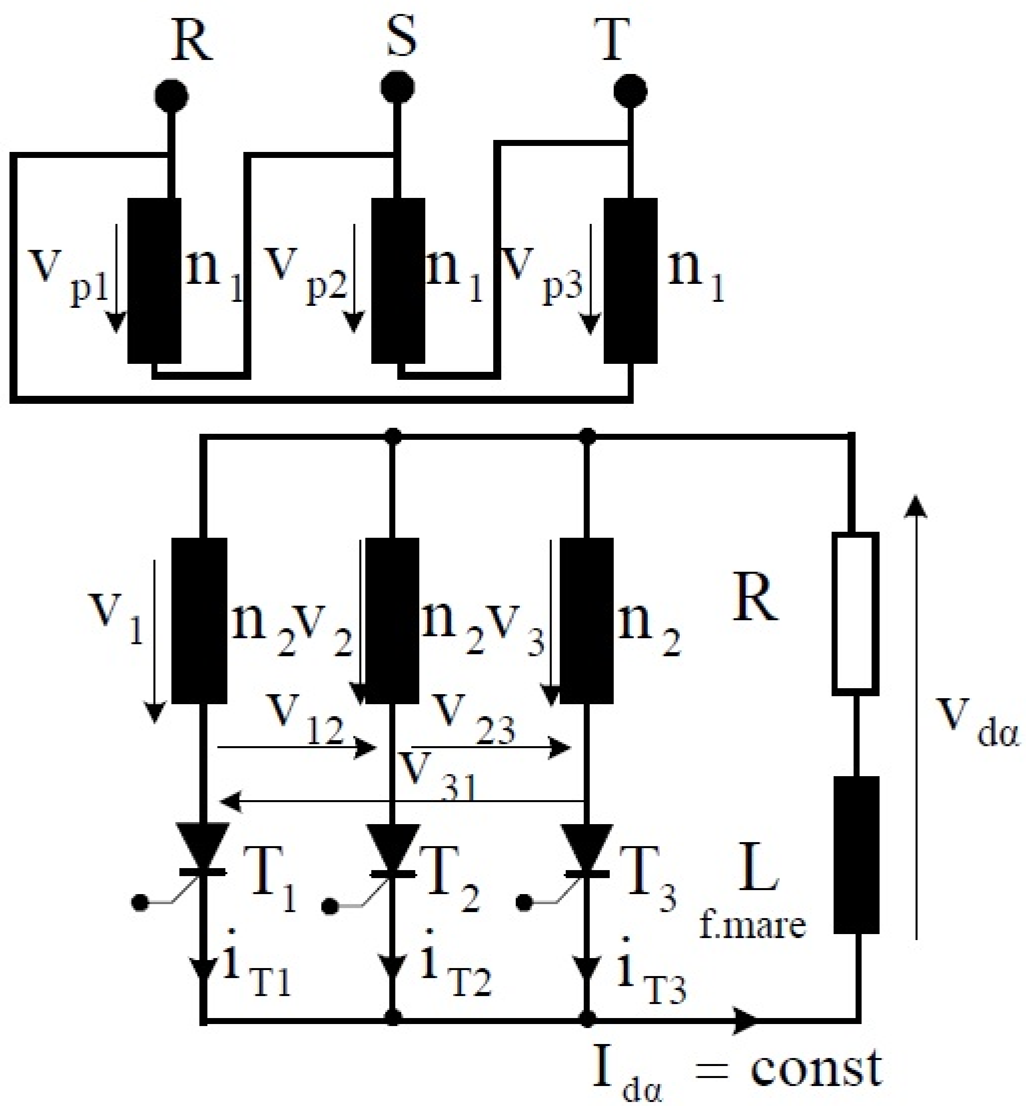
*=> E = 1.7 * 310 => E = 527V*

Redresorul folosit este de tip trifazat cu punct median comandat =>

$$=> Vd = \frac{3\sqrt{6}}{2\pi} \cdot E \cdot \cos\alpha <=> 501 = \frac{3\sqrt{6} \cdot 527 \cdot \cos\alpha}{2\pi} <=> 501 = 616.662 \cos\alpha$$

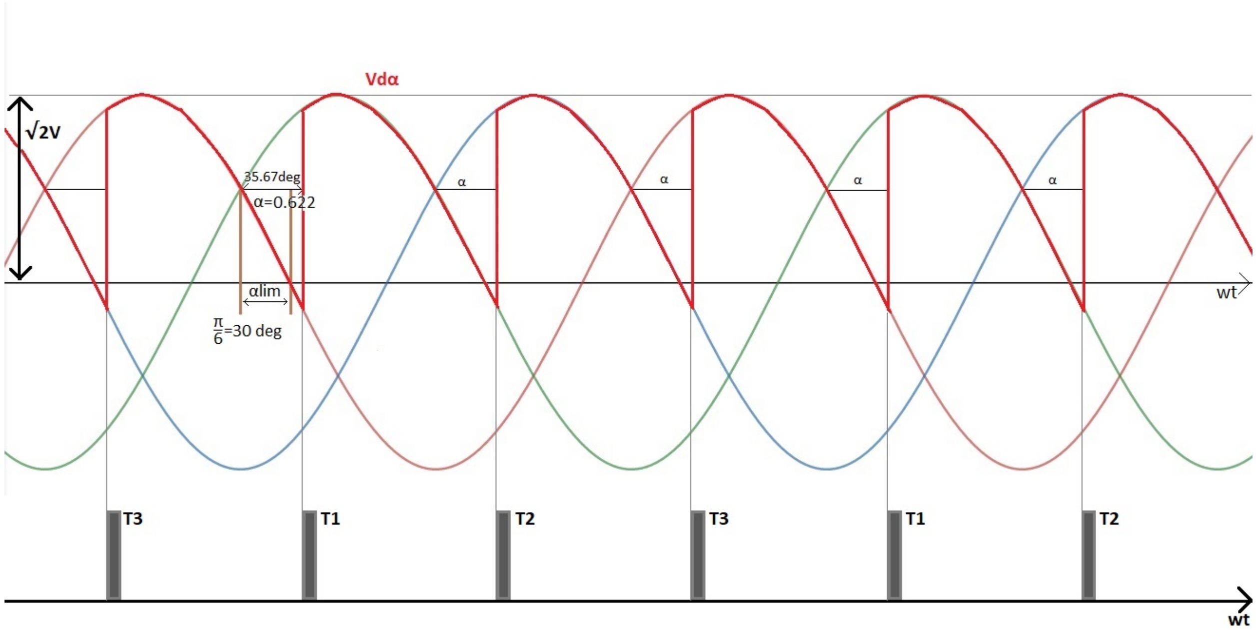
$$\cos\alpha = \frac{501}{616.662} = 0.812352 => \alpha = \cos^{-1}(0.812352) => \alpha = 35.67°$$

Schema redresor trifazat cu punct median comandat:



Redresor trifazat cu punct median funcționând pe sarcină puternic inductivă.

Forma de unda redresata si diagram de conductie a tiristoarelor:



$$Sm = Vd \cdot Id => Id = \frac{Sm}{Vd} = \frac{10^4}{501} => Id \cong 19.96A$$

$$I_{Tavr\alpha} = \frac{\sqrt{6}}{2\pi} Id \cdot cos\alpha = \frac{\sqrt{6} \cdot 19.96}{2\pi} \cdot cos(35.67°) = \frac{48.891 \cdot 0.812}{6.28} =>$$

$$=> I_{Tavr\alpha} \cong 6.32A$$

Se allege un coefficient de siguranta de 1.1 =>

$$I_{Tavr\alpha} = 1.1 \cdot 6.32 = 6.95A => I_{Tavr\alpha} = 7A$$

$$I_{TRM\alpha} = 3 \cdot I_{Tavr\alpha} = 21A$$

$$I_{Trms\alpha} = \frac{I_{TRM\alpha}}{\sqrt{3}} \cong 12.3A$$

$$V_{RRM} = \sqrt{2}E = \sqrt{2} \cdot 527 => V_{RRM} = 745.3V$$

Dupa datele calculate anterior se allege tiristorul 2N6509

Maximum Ratings (T_J = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Peak Repetitive Off-State Voltage (Note 1) (Gate Open, Sine Wave 50 to 60 Hz, T_J = 25 to 125°C) 2N6504	V_{DRM}, V_{RRM}	50	V
2N6505		100	
2N6507		400	
2N6508		600	
2N6509		800	
On-State RMS Current (180° Conduction Angles; T_C = 85°C)	$I_{T(RMS)}$	25	A
Average On-State Current (180° Conduction Angles; T_C = 85°C)	$I_{T(AV)}$	16	A
Peak Non-repetitive Surge Current (1/2 Cycle, Sine Wave 60 Hz, T_J = 100°C)	I_{TSM}	250	A²s
Forward Peak Gate Power (Pulse Width ≤ 1.0 µs, T_C = 85°C)	P_{GM}	20	W
Forward Average Gate Power (t = 8.3 ms, T_C = 85°C)	$P_{G(AV)}$	0.5	W
Forward Peak Gate Current (Pulse Width ≤ 1.0 µs, T_C = 85°C)	I_{GM}	2.0	A
Operating Junction Temperature Range	T_J	-40 to +125	°C
Storage Temperature Range	T_{stg}	-40 to +125	°C

Thermal Characteristics

Rating	Symbol	Value	Unit
*Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.5	°C/W
*Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds	T_L	260	°C

Dynamic Characteristics

Characteristic	Symbol	Min	Typ	Max	Unit
Critical Rate of Rise of Off State Voltage (Gate Open, Rated VDRM, Exponential Waveform)	dv/dt(c)	–	50	–	V/µs

Electrical Characteristics - OFF (T_C = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Typ	Max	Unit
†Peak Repetitive Blocking Current (V_{AK} = V_{DRM} = V_{RRM}; Gate Open)	T_J = 25°C	I_{DRM}, I_{RRM}	-	-	1.0	μA
	T_J = 125°C		-	-	2.0	mA

Electrical Characteristics - ON (T_C = 25°C unless otherwise noted; Electricals apply in both directions)

Characteristic		Symbol	Min	Typ	Max	Unit
* Forward On-State Voltage (Note 2) (ITM = 50 A)		V_{TM}	–	–	1.8	V
* Gate Trigger Current (Continuous dc) (V_{AK} = Rated V_{DRM} or V_{RRM}, Gate Open)	T_C = 25°C	I_{GT}	–	9.0	30	mA
	T_C = -40 °C		–	–	75	
* Gate Trigger Voltage (Continuous dc) (V_{AK} = 12 Vdc, R_L = 100 Ω, T_C = -40 °C)		V_{GT}	–	1.0	1.5	V
Gate Non-Trigger Voltage (V_{AK} = 12 Vdc, R_L = 100 Ω, T_J = 125°C)		V_{GD}	0.2	–	–	V
*Holding Current (V_D = 12 Vdc, Initiating Current = 200 mA, Gate Open)	T_C = 25°C	I_H	–	18	40	mA
	T_C = -40 °C		–	–	80	
* Turn-On Time (I_{TM} = 25 A, I_{GT} = 50 mAdc)		t_{gt}	–	1.5	2.0	μs
Turn-Off Time (V_{RM} = rated voltage)	(I_{TM} = 25 A, I_R = 25 A)	t_q	-	-	15	μs
	(I_{TM} = 25 A, I_R = 25 A, T_J = 125°C)		-	-	35	