

## TP7 : Redresseur Triphasé à Thyristors (PD3T)

**Objectif :** Étudier la commande des thyristors dans un pont triphasé PD3T et l'évolution de la tension selon l'angle  $\psi$ . **Manipulations :**

- Étude pour angle de commande  $\psi = 120^\circ$  :  $u_c$ ,  $i_c$ , intervalles de conduction.
- Étude pour  $\psi = 45^\circ$ .
- Mesures :  $U_{chmoy}$ ,  $U_{cheff}$ ,  $I_{chmoy}$ ,  $I_{cheff}$ , ainsi que les valeurs efficaces et moyennes des thyristors.

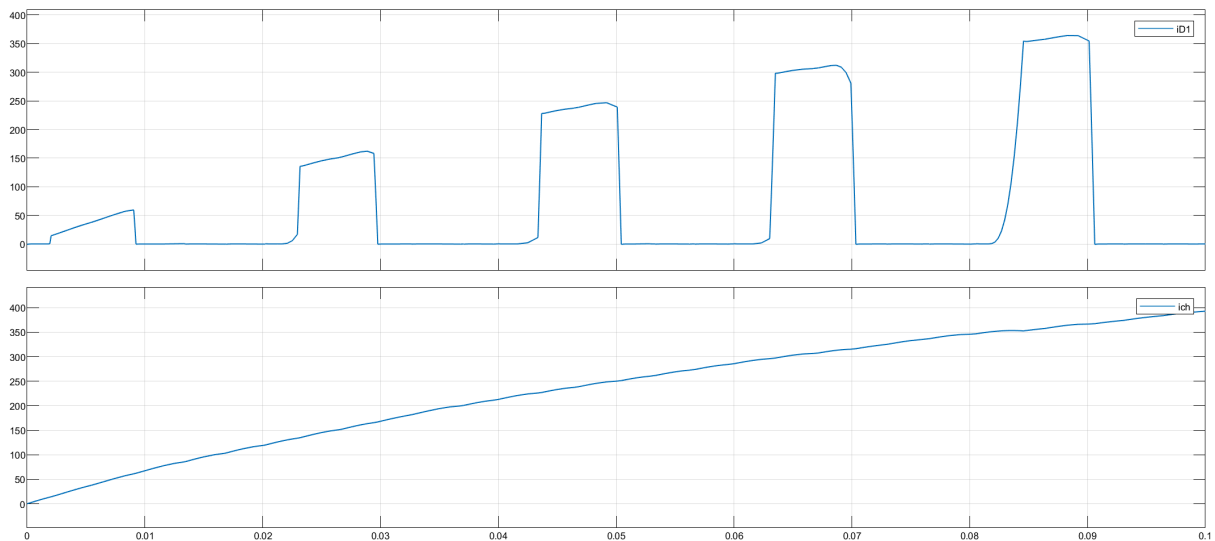
**Partie : Onduleur Triphasé – Commande Pleine Onde** **Objectif :** Relever et analyser les formes d'ondes à la sortie d'un onduleur triphasé sous deux types de commande : pleine onde et MLI.

### Commande pleine onde

Chaque interrupteur est fermé pendant  $T/2$ . Les transistors sont commandés selon :

- T1 :  $0^\circ - 180^\circ$
- T2 :  $120^\circ - 300^\circ$
- T3 :  $240^\circ - 420^\circ$
- T'1 :  $180^\circ - 360^\circ$
- T'2 :  $300^\circ - 480^\circ$
- T'3 :  $60^\circ - 240^\circ$


Simulation sur charge  $R = 10\Omega$ ,  $L = 40\text{mH}$ . Visualisation des tensions et courants de ligne, évaluation de la puissance  $P_c$ .



### Travail à effectuer

**Préciser la séquence de commande des interrupteurs**

**L'interrepteur K1 :**

 Block Parameters: Pulse Generator ✕

Time-based is recommended for use with a variable step solver, while Sample-based is recommended for use with a fixed step solver or within a discrete portion of a model using a variable step solver.

Parameters

Pulse type: Sample based ▼

Time (t): Use simulation time ▼

Amplitude:

1 ⋮

Period (number of samples):

0.002 ⋮

Pulse width (number of samples):

50 ⋮


Phase delay (number of samples):

0 ⋮

Sample time:

1 ⋮

☐ Interpret vector parameters as 1-D

 OK Cancel Help Apply

L'intercepteur K1' :

Block Parameters: Pulse Generator5

end

Pulse type determines the computational technique used.

Time-based is recommended for use with a variable step solver, while Sample-based is recommended for use with a fixed step solver or within a discrete portion of a model using a variable step solver.

Parameters

Pulse type: Time based

Time (t): Use simulation time

Amplitude: 1

Period (secs): 0.002


Pulse Width (% of period): 50

Phase delay (secs):  $(.002*180)/360$  0.001

☐ Interpret vector parameters as 1-D

OK Cancel Help Apply

L'intercepteur K2 :

 Block Parameters: Pulse Generator1

Y(t) = 0  
end

Pulse type determines the computational technique used.  
  
Time-based is recommended for use with a variable step solver, while  
Sample-based is recommended for use with a fixed step solver or within  
a discrete portion of a model using a variable step solver.

Parameters

Pulse type: Sample based

Time (t): Use simulation time


Amplitude:  
1

Period (number of samples):  
0.002


Pulse width (number of samples):  
50

Phase delay (number of samples):  
(.002\*120)/3600.00066667

Sample time:

OKCancelHelpApply

L'intercepteur K2' :

 Block Parameters: Pulse Generator6 ×

Time-based is recommended for use with a variable step solver, while Sample-based is recommended for use with a fixed step solver or within a discrete portion of a model using a variable step solver.

Parameters

Pulse type: Sample based ▼

Time (t): Use simulation time ▼

Amplitude:

1 ⋮

Period (number of samples):

0.002 ⋮

Pulse width (number of samples):

50 ⋮


Phase delay (number of samples):

$(.002*300)/360$  0.0016667 ⋮

Sample time:

1 ⋮

☐ Interpret vector parameters as 1-D

 OK Cancel Help Apply

L'intercepteur K3 :

Block Parameters: Pulse Generator2

end

Pulse type determines the computational technique used.

Time-based is recommended for use with a variable step solver, while Sample-based is recommended for use with a fixed step solver or within a discrete portion of a model using a variable step solver.

Parameters

Pulse type: Time based

Time (t): Use simulation time

Amplitude: 1

Period (secs): 0.002

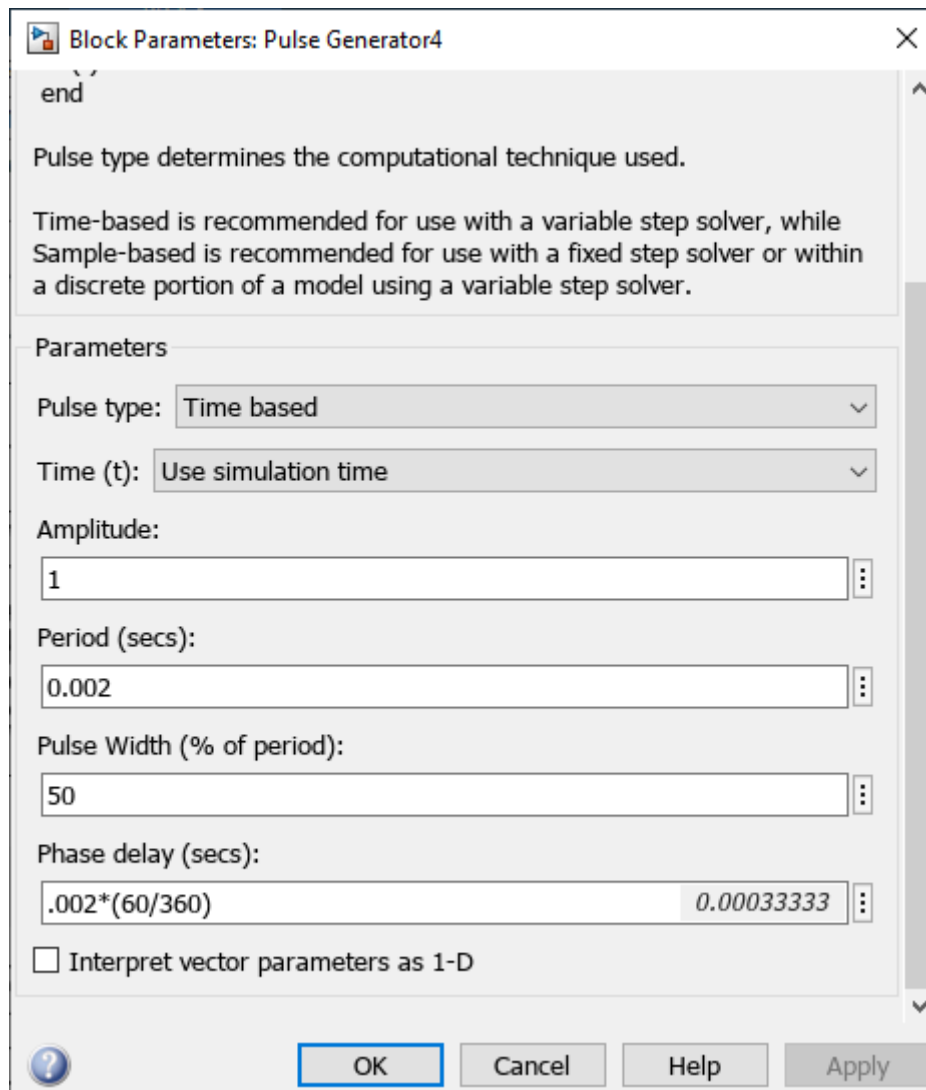
Pulse Width (% of period): 50

Phase delay (secs):  $(.002*240)/360$  0.0013333

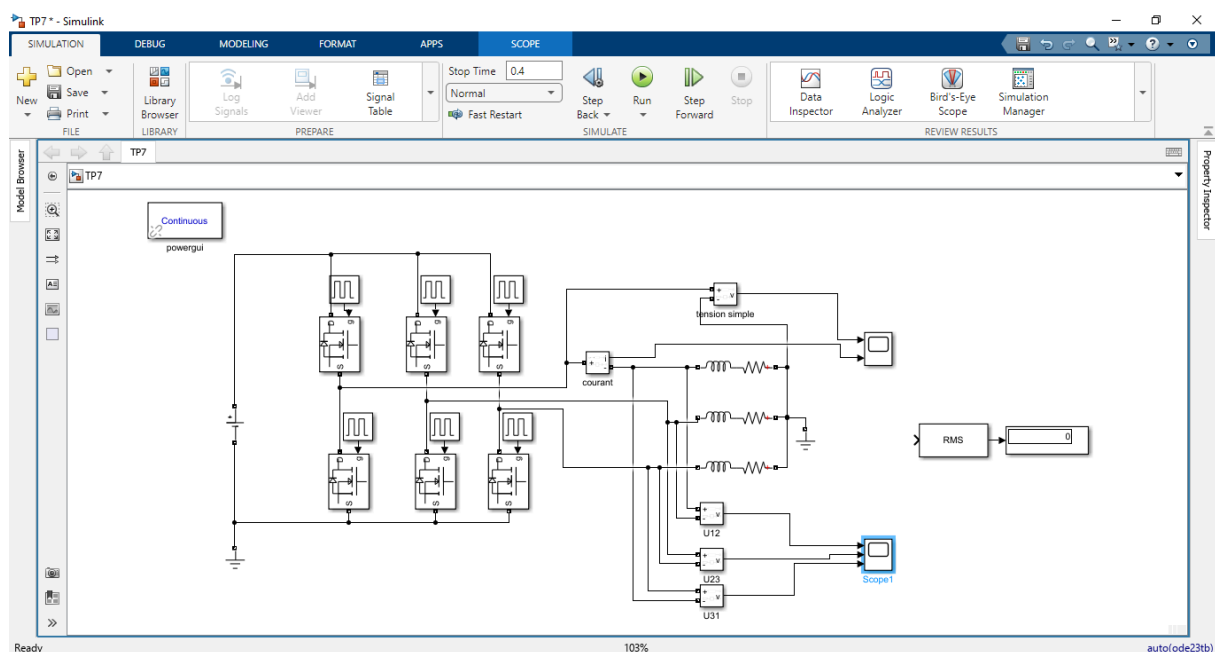
☐ Interpret vector parameters as 1-D

OK Cancel Help Apply

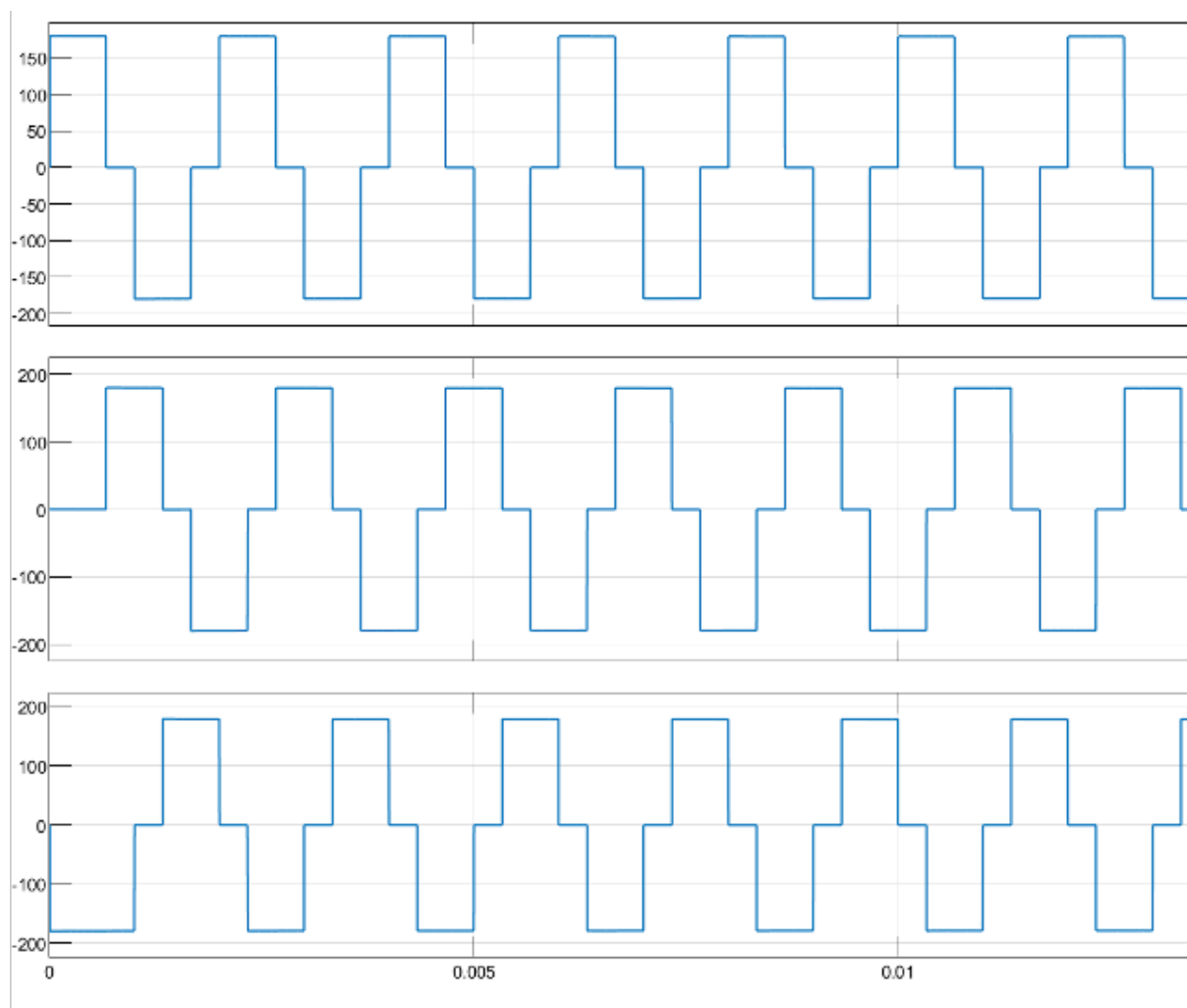
L'interrepteur K3' :



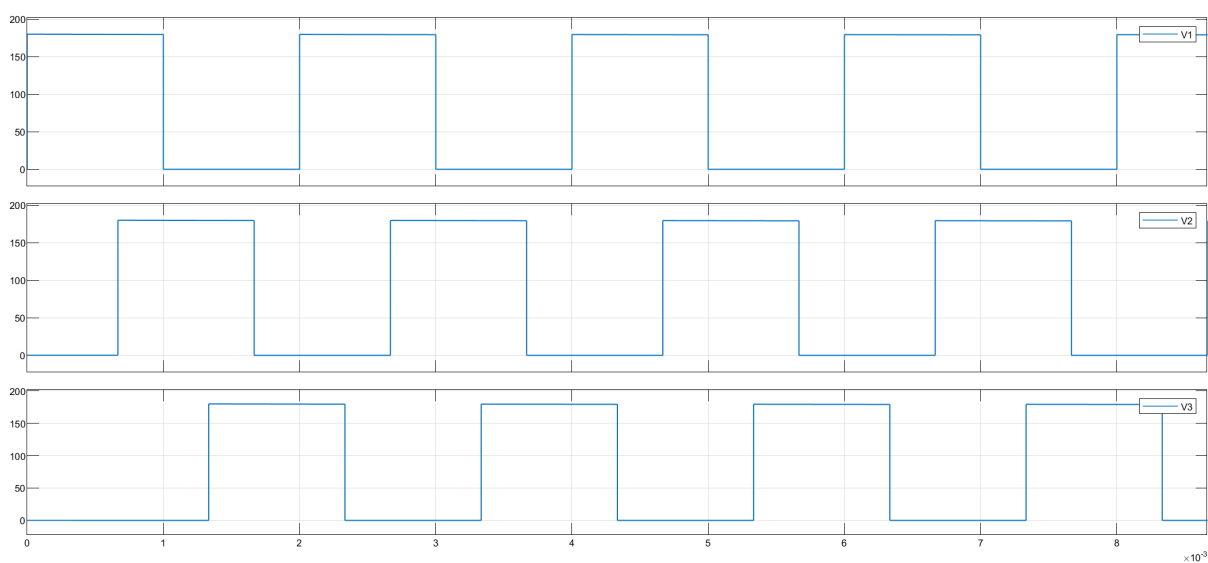
Relever les formes d'ondes des tensions composées,  $U_{12}(t)$ ,  $U_{23}(t)$ ,  $U_{31}(t)$ . Etablir l'expression de  $U_{cheff}$ , en fonction de  $E$ .



Le graphe des tension U12, U23 et U31



Représenter les tensions simples  $V_{1N}$ ,  $V_{2N}$ ,  $V_{3N}$ . Etablir l'expression de  $V_{\text{cheff}}$  en fonction de  $E$ .



La valeur de tension efficace  $V_{\text{cheff}}$  vaut:



$$V_{\text{cheff}} = \frac{1}{T} \sqrt{\int_{T_1}^{T_2} V_{\text{max}}^2(t) \cdot dt} = \frac{1}{2} \sqrt{\int_0^2 V_{\text{max}}^2 \cdot dt} = \frac{1}{2} \sqrt{E^2(2-0)} = \frac{1}{2} E\sqrt{2}$$

**Donner l'expression du courant de ligne  $i_1(t)$**

**Calculer la puissance  $P_c$  reçue par la charge**

**Exprimer  $i_{Ti}$ , et  $i_{Di}$  en fonction de  $i_{ki}$  et du signe de  $i_{ki}$ .**

### **Commande MLI**

Signaux de commande obtenus par comparaison : sinusoïde modulante vs signal triangulaire porteuse. Paramètres :  $m = 0.6$ ,  $p = 6$ . Étude pour  $m = 0.8$ . Mesures :  $U_{12}$ ,  $V_{1N}$ ,  $i_1$ ,  $i_{k1}$ ,  $i_{k'1}$ ,  $U_{\text{eff}}$ ,  $V_{\text{eff}}$ ,  $I_{\text{eff}}$ , puissance  $P_s$  et  $P_c$ . Vérification de la nature sinusoïdale de la tension de sortie.