Rendement

$\eta = \dfrac{W_{utile}}{W_{utile} + W_{pertes}}$

W = Puissance

Caractéristiques

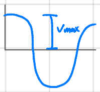
$V_{moy} = \langle V \rangle = \dfrac{1}{T} \int_{(T)} s(t)\,dt$

T = taux = période

$V_{eff} = V_{RMS} = \sqrt{\dfrac{1}{T} \int_{(T)} s^2(t)\,dt}$

Sin $= \dfrac{V_{max}}{\sqrt{2}}$ triangle $= \dfrac{V_{max}}{\sqrt{3}}$ Carrer $= V_{max}$

$V = V_{max} \cdot \sin(\omega t - \varphi)$

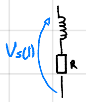


Lissage

ΔV_s = min à max

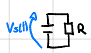
- inductance en série avec la Charge

$\Delta I \approx \dfrac{\Delta V_s}{\sqrt{R^2 + (2L\omega)^2}}$



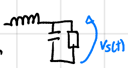
- Condensateur parallèle

$\Delta V_s \approx \dfrac{V \cdot \sqrt{2}}{2fRC}$



$f = 1/T \to$ fréquence réseau

- Cellule LC



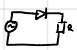
$\Delta V_s \approx \dfrac{V \cdot \sqrt{2}}{|1 - 4LC \cdot \omega^2|}$

Circuits

$V = V_{RMS}$ entrée

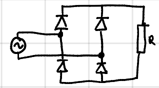
τ = taux d'ondulation $= \dfrac{\Delta V_s}{V_{moy}}$ ou $= \dfrac{\Delta i_s}{i_{moy}}$

P1 : mono simple



$V_{moy} = \dfrac{V \cdot \sqrt{2}}{\pi}$

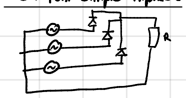
PD2 : Pont double monophasé



$V_{moy} = \dfrac{2V \cdot \sqrt{2}}{\pi}$

$\tau = \dfrac{\pi \cdot \sqrt{2}}{2 \cdot \sqrt{2}}$

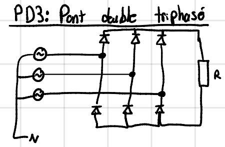
P3 : Pont simple triphasé



$V_{moy} = \dfrac{3V \cdot \sqrt{6}}{2\pi}$

$\tau = \dfrac{\pi}{3\sqrt{3}}$

PD3 : Pont double triphasé



$V_{moy} = \dfrac{3V\sqrt{6}}{\pi}$

$\tau = \dfrac{\pi(1 - \sqrt{3}/2)}{3}$

Rappel

$u(t) = R \cdot i(t)$

$u(t) = L \cdot \dfrac{di(t)}{dt}$

$i(t) = C \cdot \dfrac{dv(t)}{dt}$

$W = VI = \dfrac{V^2}{R} = RI^2$

$C = 1/j\omega C$

$L = j\omega L$

Pont mixte
↳ Thyristor + Diodes

Roue libre
↳ Diode contre Charge

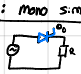
Circuits commandé

$V = V_{RMS}$ entrée

τ = taux d'ondulation $= \dfrac{\Delta V_s}{V_{moy}}$ ou $= \dfrac{\Delta i_s}{i_{moy}}$

en bleu thyristors

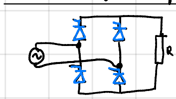
P1 : mono simple commandé



$V_{moy} = \dfrac{V \cdot \sqrt{2}}{2\pi}(1 + \cos(\theta_0))$

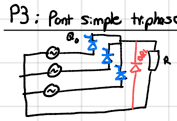
PD2 : Pont double monophasé

lissé



$V_{moy} = \dfrac{2V \cdot \sqrt{2}}{\pi} \cos(\theta_0)$

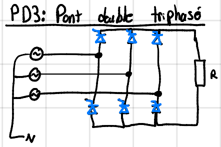
P3 : Pont simple triphasé commandé



lissé ou roue libre

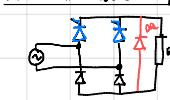
$V_{moy} = \dfrac{3V \cdot \sqrt{6}}{2\pi} \cos(\theta_0)$

PD3 : Pont double triphasé



$V_{moy} = \dfrac{3V\sqrt{6}}{\pi} \cos(\theta_0)$

PD2 : Pont double monophasé



Pont mixte ou Roue libre

$V_{moy} = \dfrac{V \cdot \sqrt{2}}{\pi}(1 + \cos(\theta_0))$

taux ondulation

Rendu P.87

fem = E

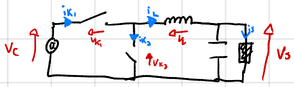
faire dessin graphique

Moteur

DC-DC

$\alpha = \frac{t_h}{T} = \frac{T_{on}}{T} = \frac{\alpha T}{T}$

Buck



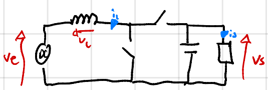
$V_s \approx V_{s\,moy} = \alpha V_e$

$I_s = \frac{\alpha V_e}{R}$

$\Delta i_L = \frac{V_e \cdot T \cdot \alpha(1-\alpha)}{L} = \frac{V_e \cdot \alpha(1-\alpha)}{Lf}$

$\Delta V_{c\,max} \approx \frac{V_e T^2}{8\pi LC} = \frac{V_e}{8\pi LC f^2}$

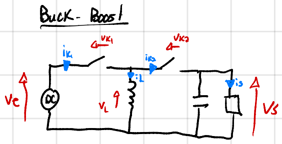
Boost



$V_s = \frac{V_e}{(1-\alpha)}$ $\Delta i_L = \frac{V_e T \alpha}{L} = \frac{V_e \alpha}{L \cdot f}$

$I_s = \frac{V_e}{R \cdot (1-\alpha)}$ $\Delta V_s = \frac{\alpha \cdot I_s}{Cf} = \frac{\alpha V_s}{R \cdot C \cdot f}$

Buck-Boost



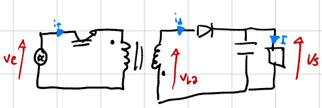
$V_s = -\frac{\alpha V_e}{(1-\alpha)}$ $\Delta i_L = \frac{V_e T \alpha}{L} = \frac{V_e \cdot \alpha}{L \cdot f}$

$I = \frac{\alpha \cdot V_e}{R(1-\alpha)}$ $\Delta V_s = \frac{\alpha \cdot I_s}{C \cdot f} = \frac{\alpha V_s}{RCf}$

Conduction discontinue

$V_s = \frac{V_e}{1 + \frac{2 L I_s}{\alpha^2 T V_e}}$ $I_{Lm} = \frac{T \cdot V_e}{8L}$

Flyback



$V_s = \frac{m \cdot \alpha \cdot V_e}{(1-\alpha)}$ $I = \frac{m \cdot \alpha \cdot V_e}{R(1-\alpha)}$

$m = \frac{N_1}{N_2}$

DC-AC

Recopier note de lectures

Thermique

Conduction = passage de courant = perte tension

Commutation = Chaque bloquage ou ammorçage prends de l'énergie

Diodes

$P_{d\,cond} = V_s \cdot i_{d\,moyen} + r_d \cdot I_{d\,eff}^2$

$P_{d\,cond} \approx V_f \cdot I_{d\,moyen}$

Mos

$P_{Mos\,cond} = R_{DS\,on} \cdot I_{d\,eff}$

$P_{IGBT\,cond} = V_{CE\,sat} \cdot I_{c\,moyen}$

$W_{com} = \frac{1}{2} V I (t_{on} + T_{off})$

$P_{com} = f \cdot W_{com}$

Temperature

Resistance thermique

$T_1 - T_2 = R_{th} \cdot P_{th}$ $P_{th} = P_{cond} + P_{com}$

$R_{th} = \frac{\lambda e}{S}$

Capacite thermique

$P_{th} = \frac{dQ}{dt} = C_v \cdot \frac{dT}{dt}$