電験どうでしょう管理人

KWG presents

電験オンライン塾

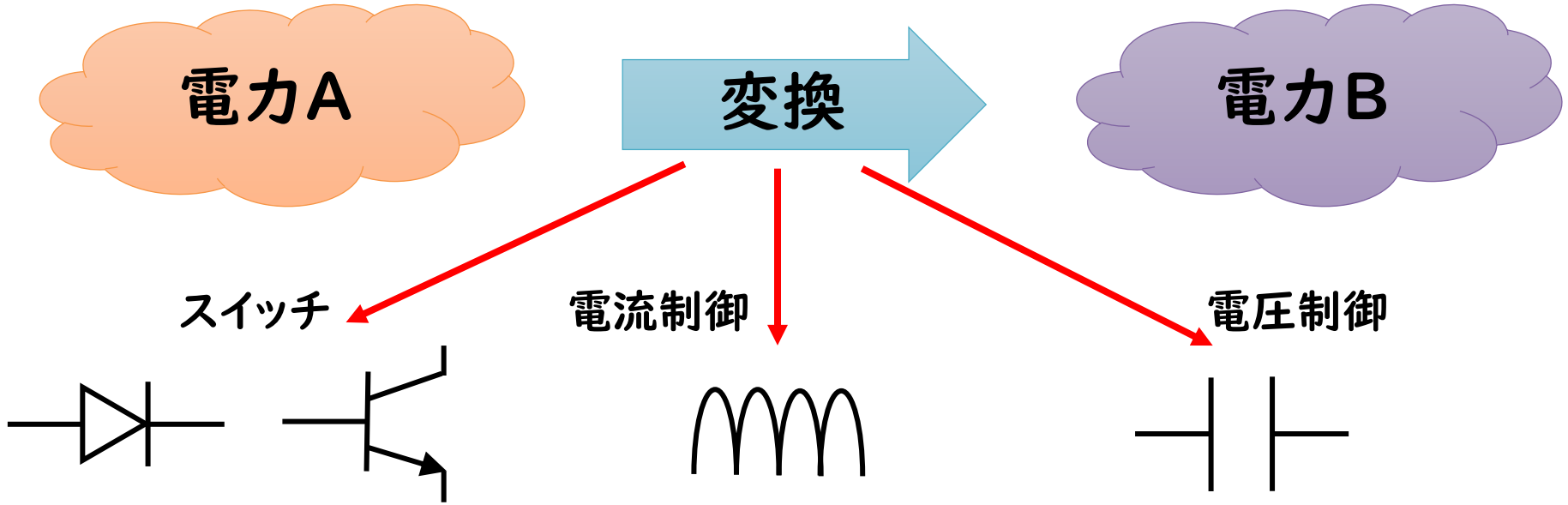
第13回 パワエレ（2）

2021.05.22 Sat

パワエレとは

パワーエレクトロニクス
電力用半導体スイッチング素子を利用して電力の変換や制御とそれらの応用を取り扱う技術分野

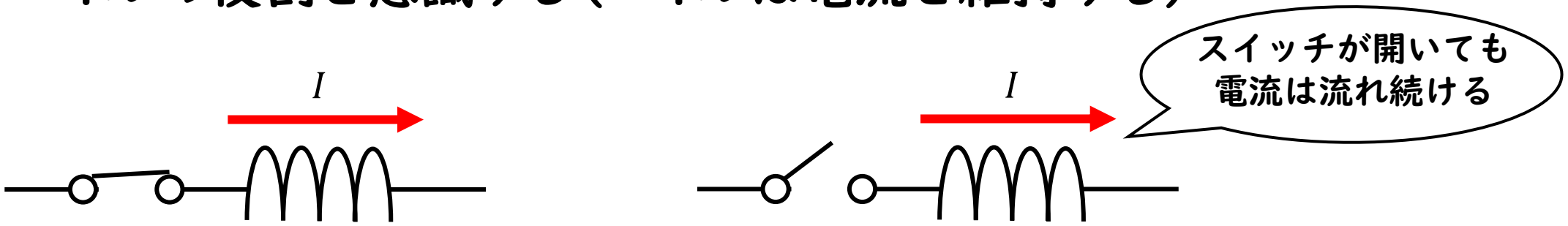
ダイオード、トランジスタなど　→　“スイッチ”として使用する



パワエレの勘所

1. 電流の流れを意識する（電圧に惑わされないこと）

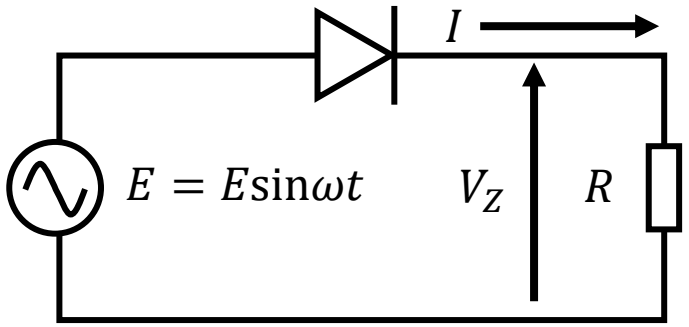
2. コイルの役割を意識する（コイルは電流を維持する）

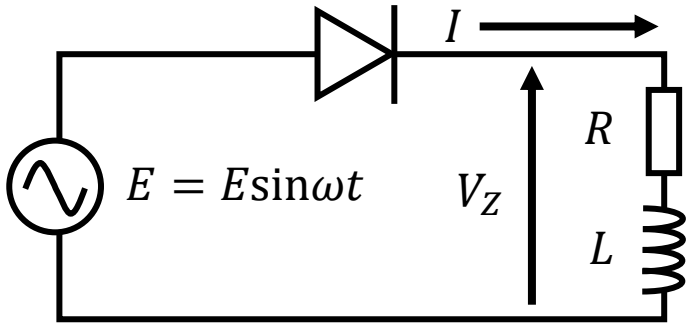


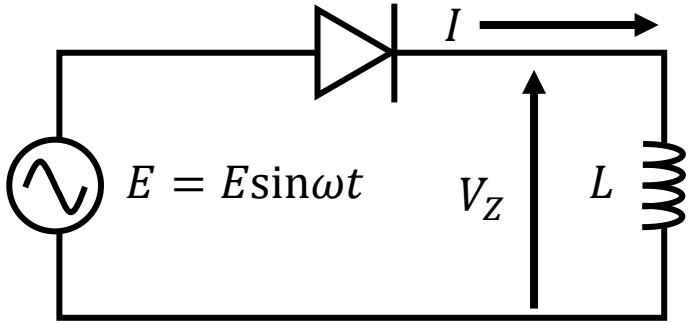
3. 過渡応答を意識する

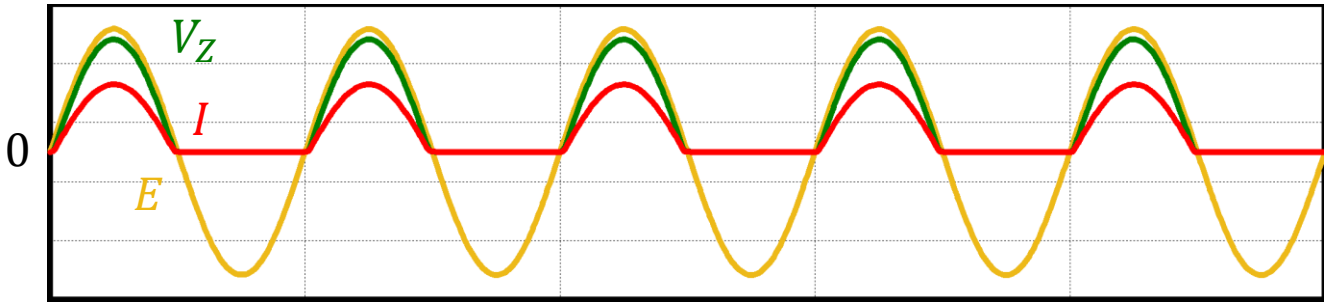
直流回路や交流回路の考え方とパワエレの回路の動きは全く別物

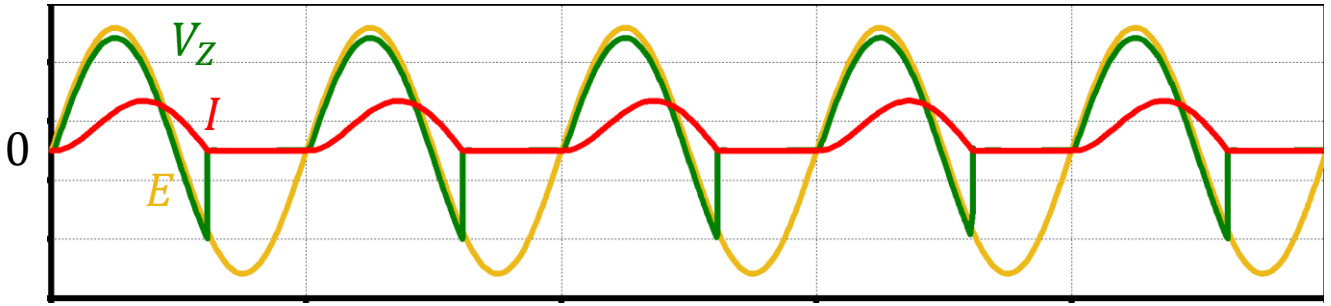
半波整流回路

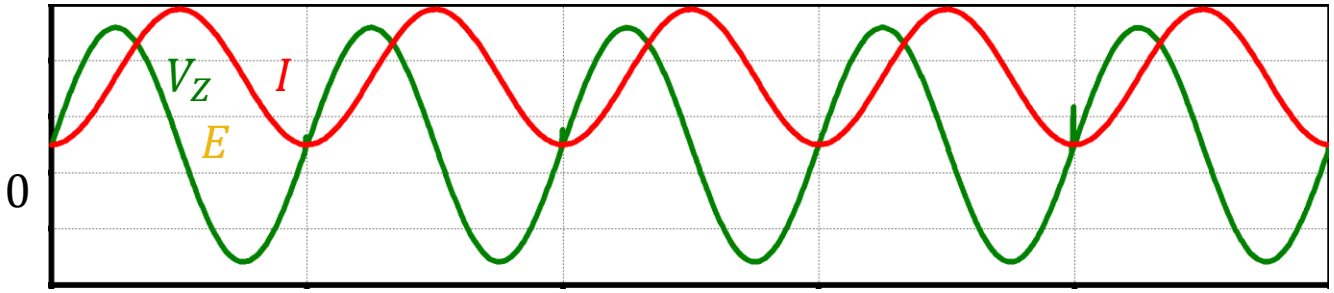




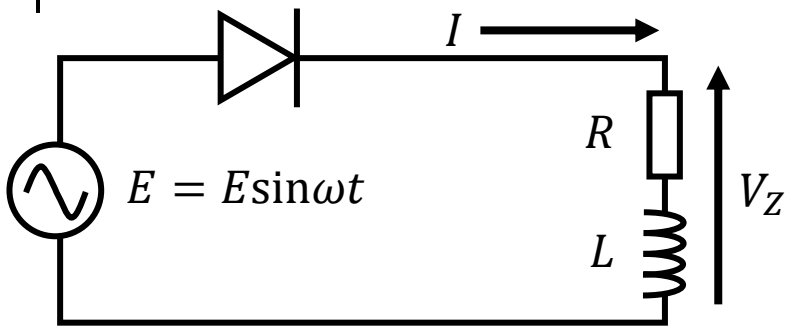


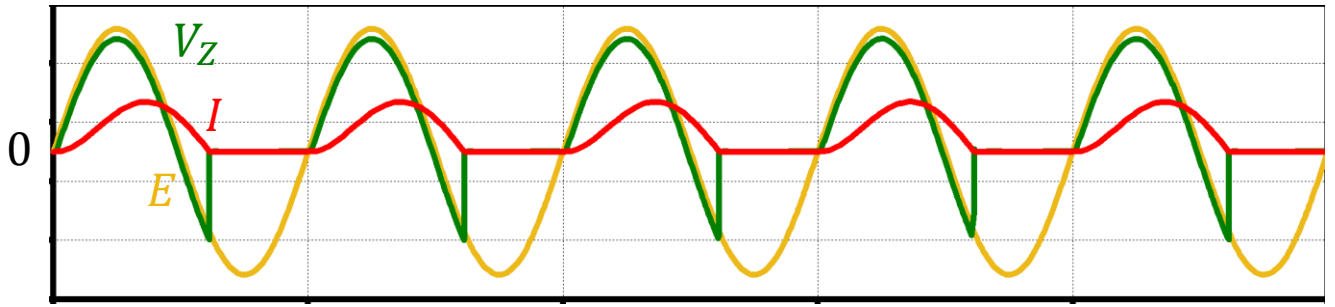


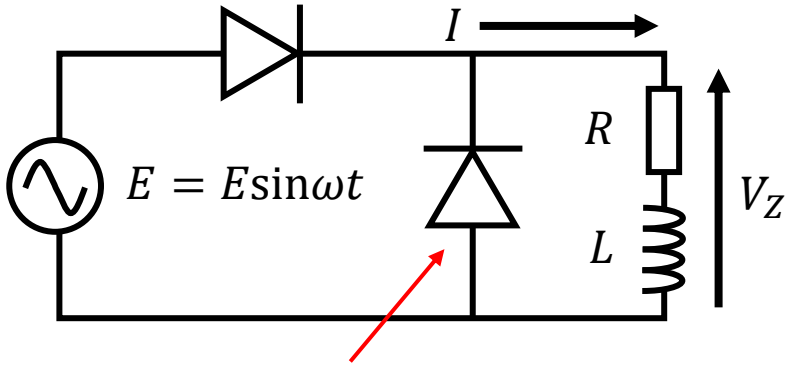


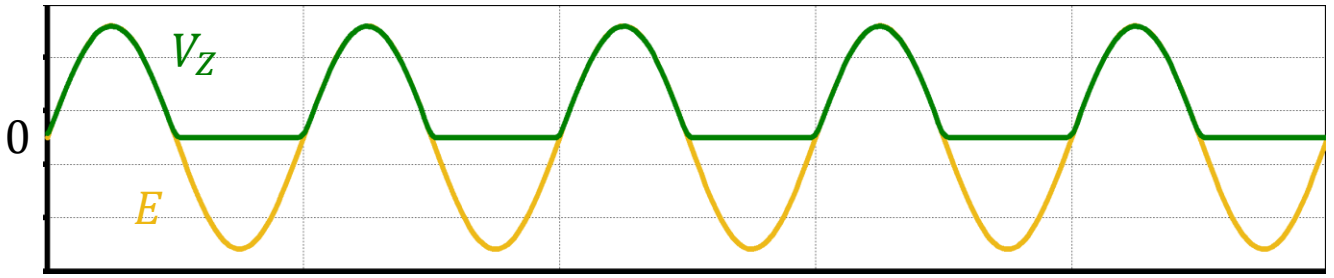


半波整流回路と還流ダイオード



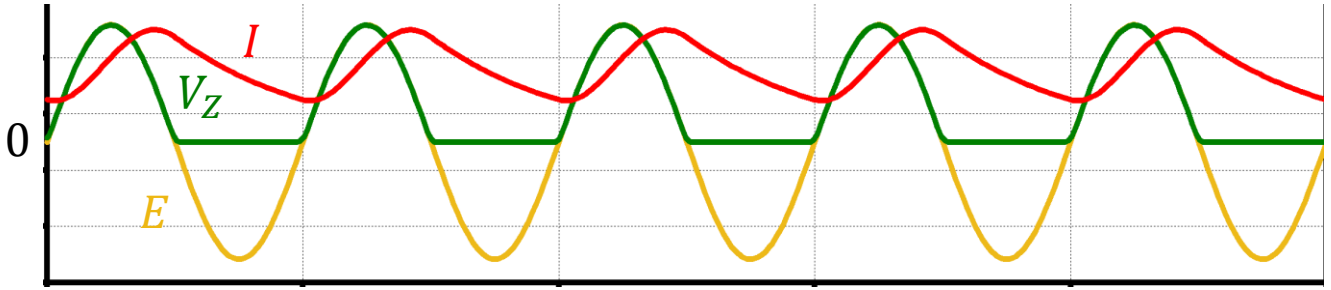




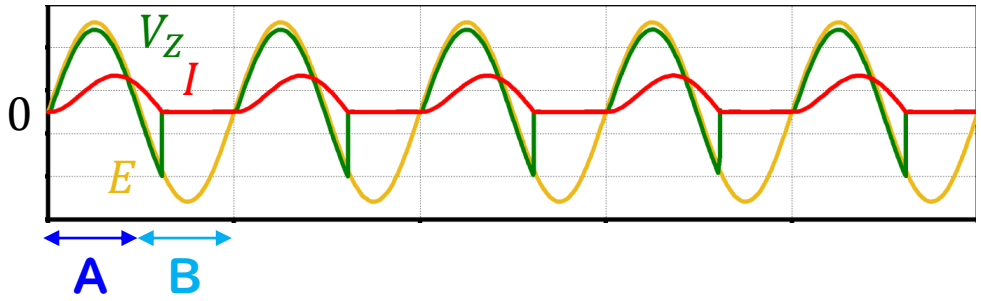


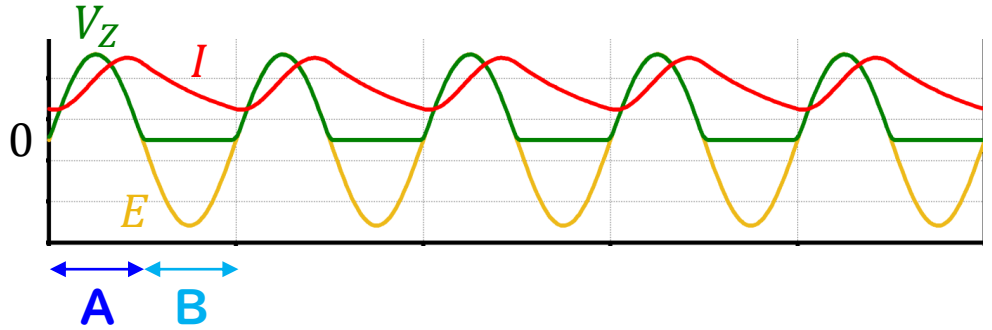
還流ダイオード

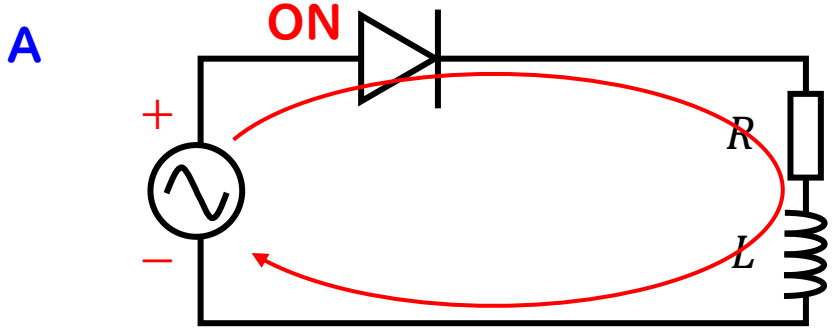
V_ZとIの波形が変化する

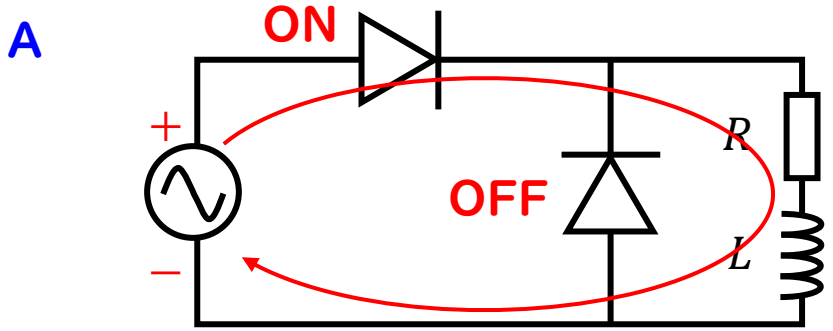


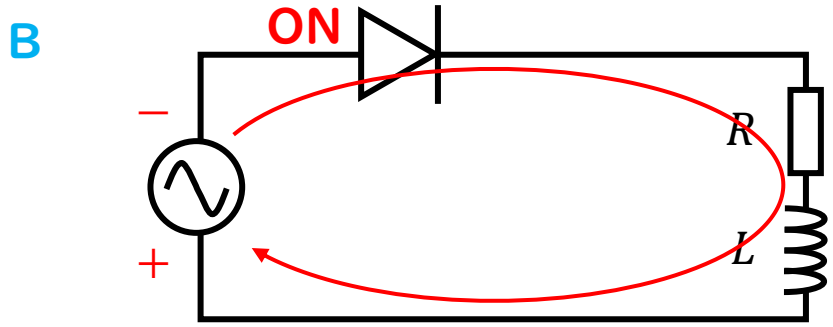
半波整流回路と還流ダイオード

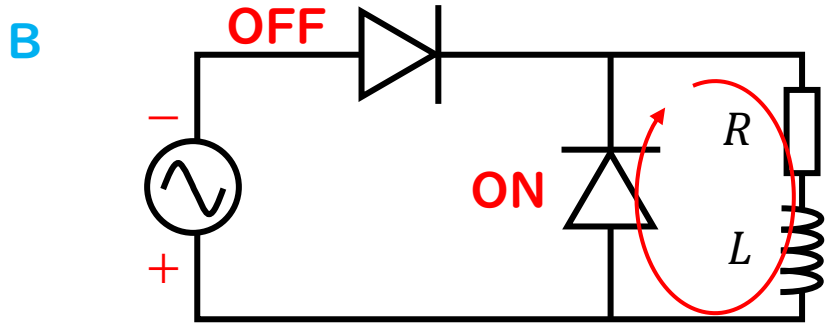




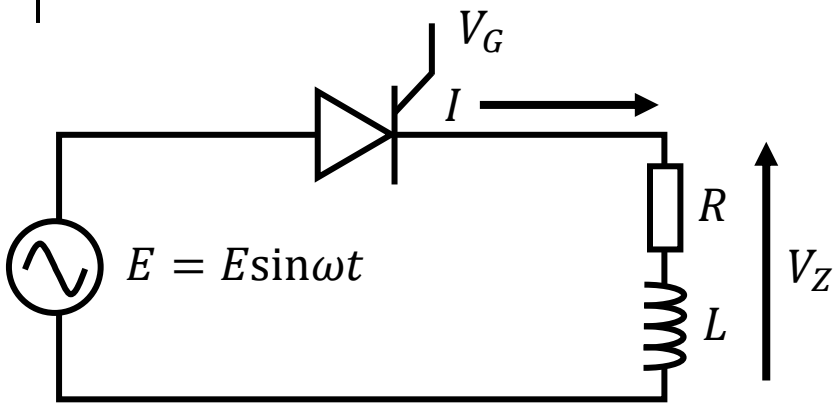


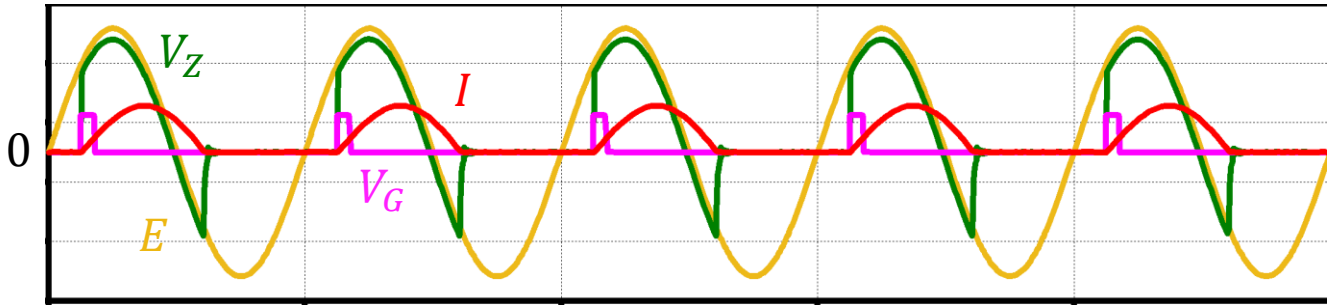


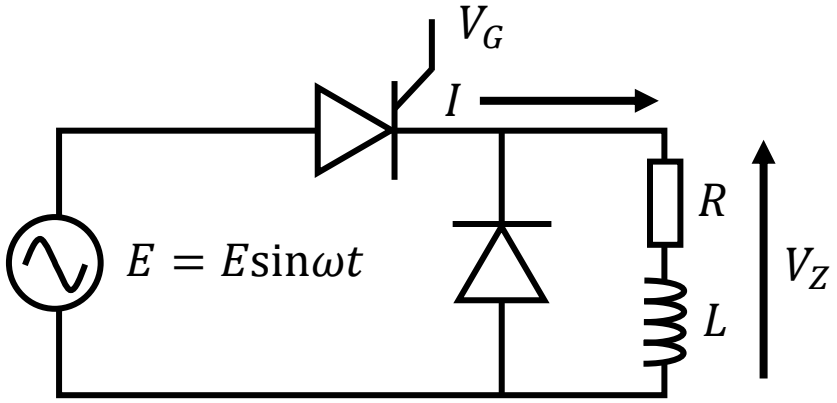


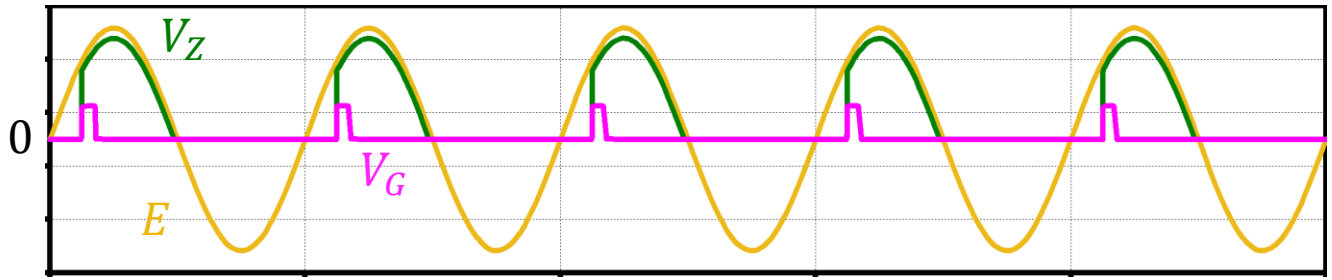


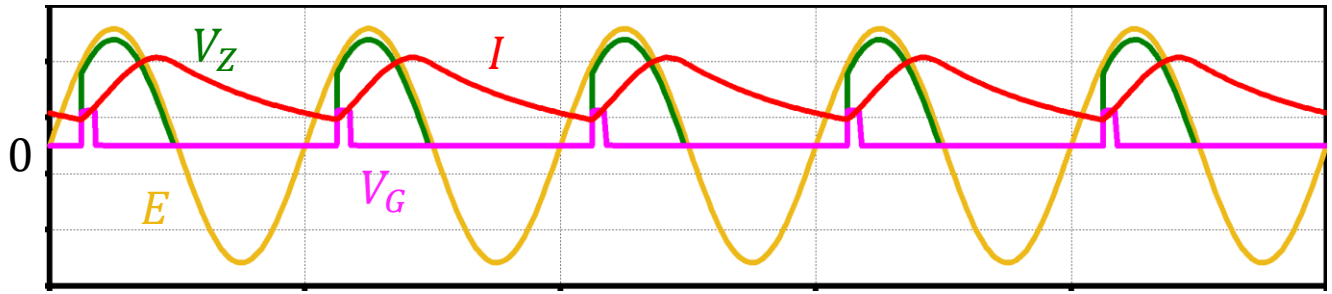
半波整流回路（サイリスタ）と還流ダイオード



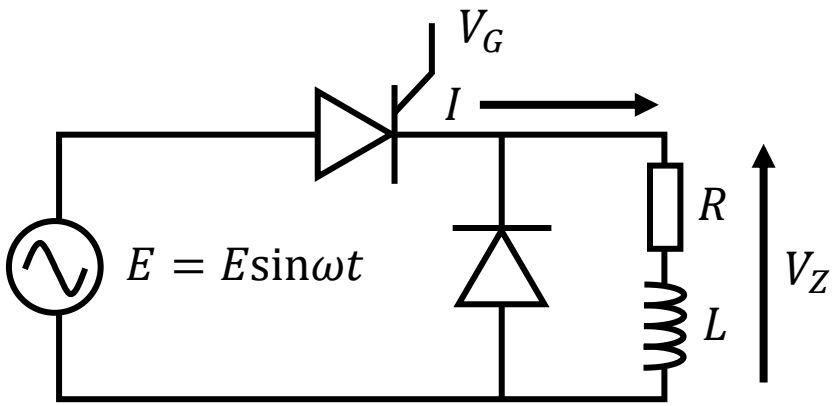


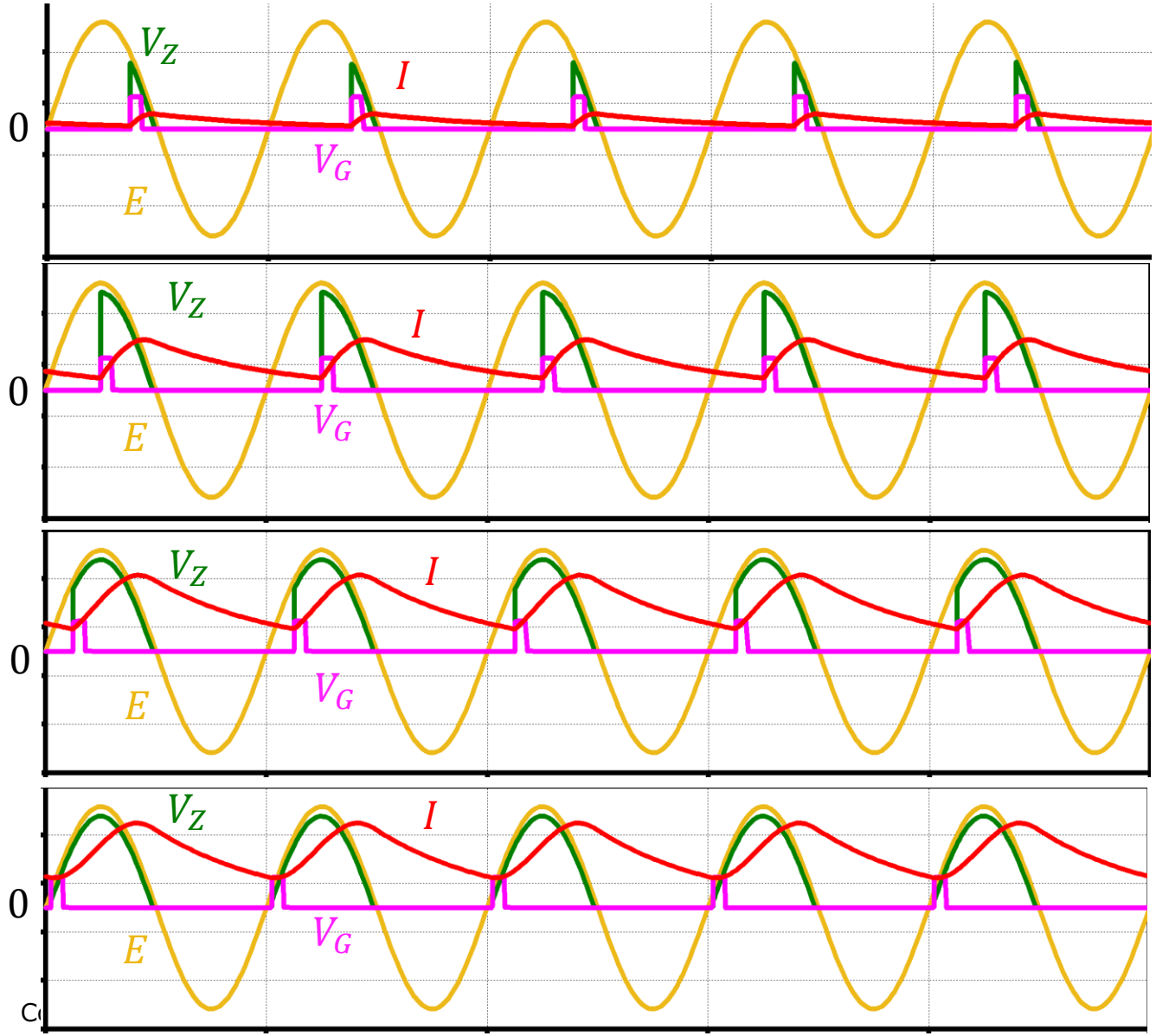






半波整流回路（サイリスタ）と還流ダイオード

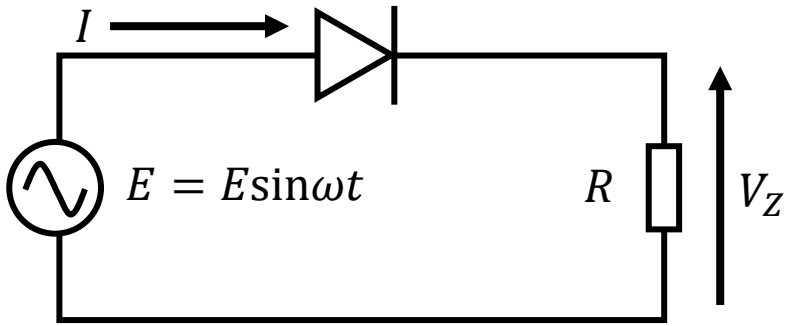


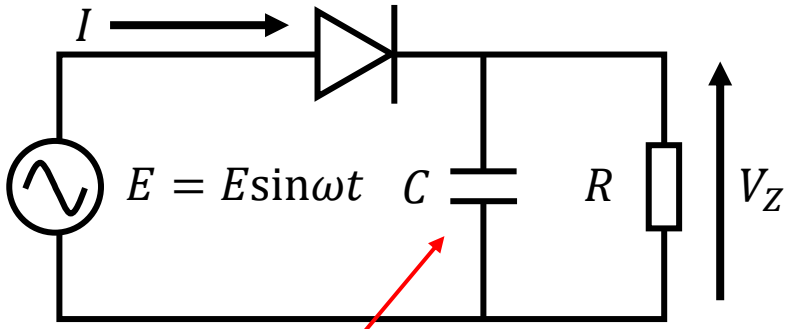


ゲートのタイミングを制御することで
電流の大きさを制御することができる

サイリスタ+還流ダイオード+コイル
→DC電流の制御

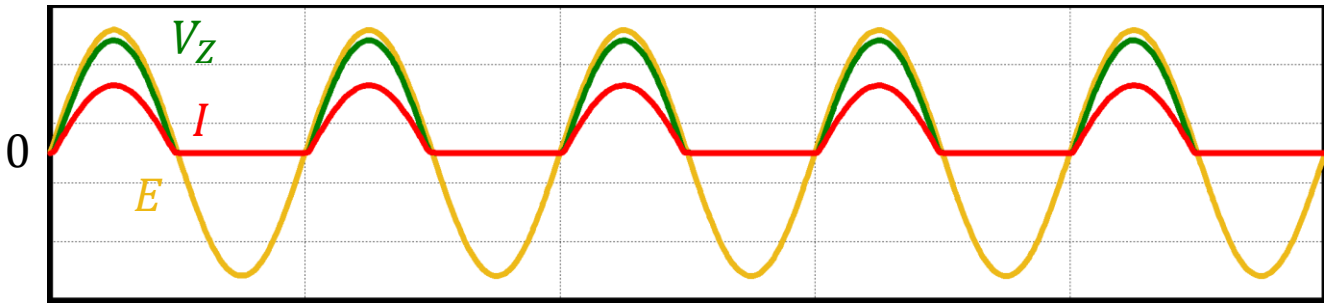
半波整流回路+コンデンサ

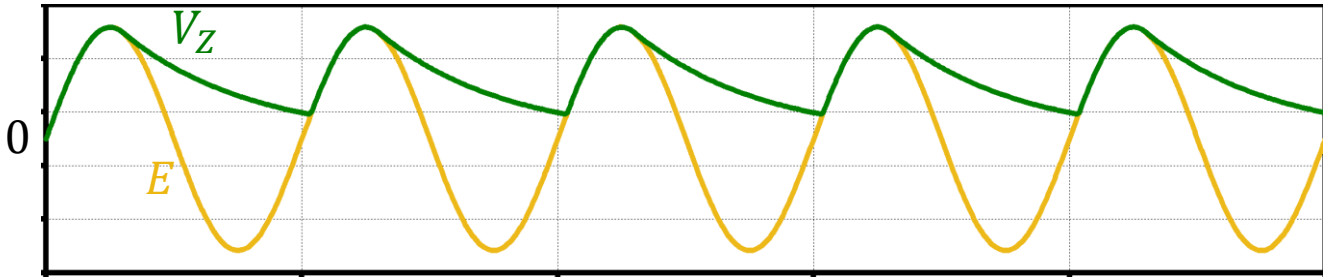


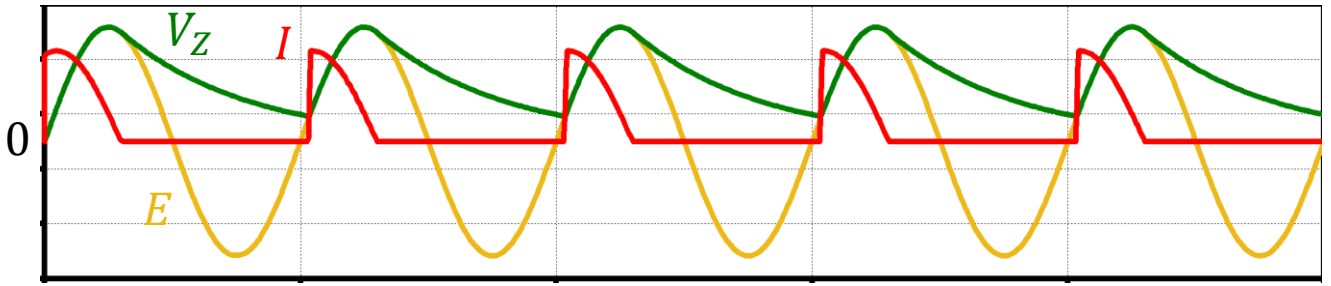


コンデンサインプット

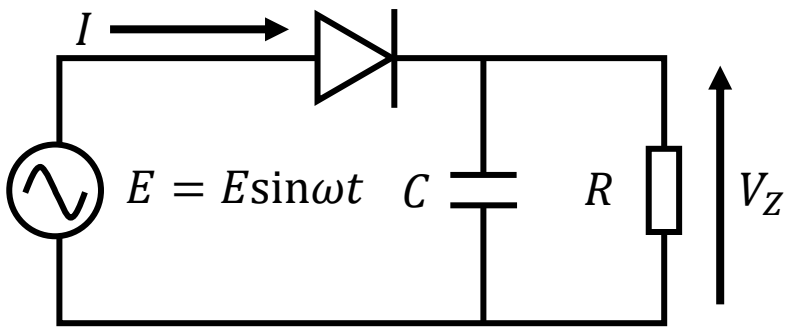
V_Zの波形が直流に近くなる







半波整流回路+コンデンサ

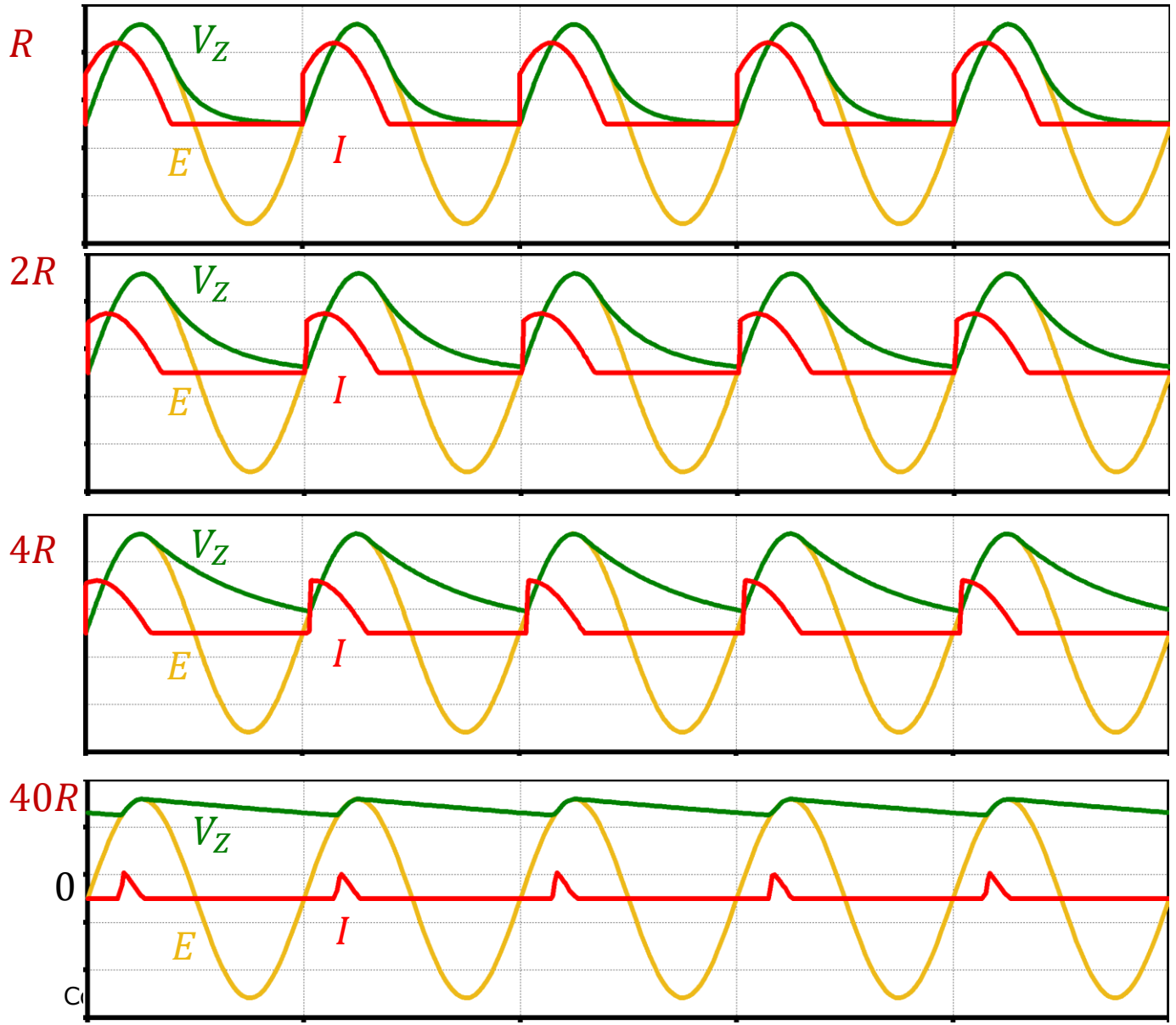


コンデンサによりV_ZはDC電圧に近づく

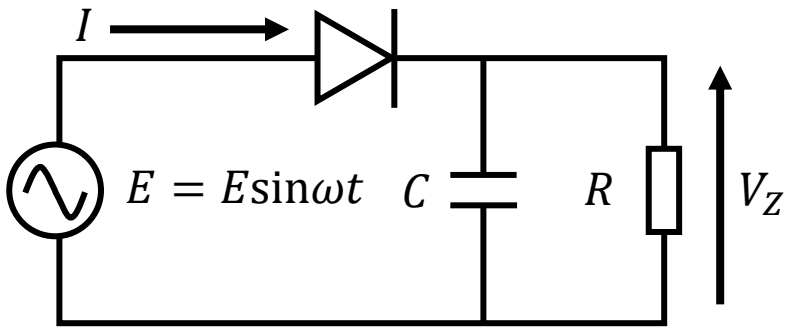
＜電圧の変化の仕方＞
時定数$\tau = CR$で決まる
RまたはCが大きくなると
V_ZはDC電圧に近づく

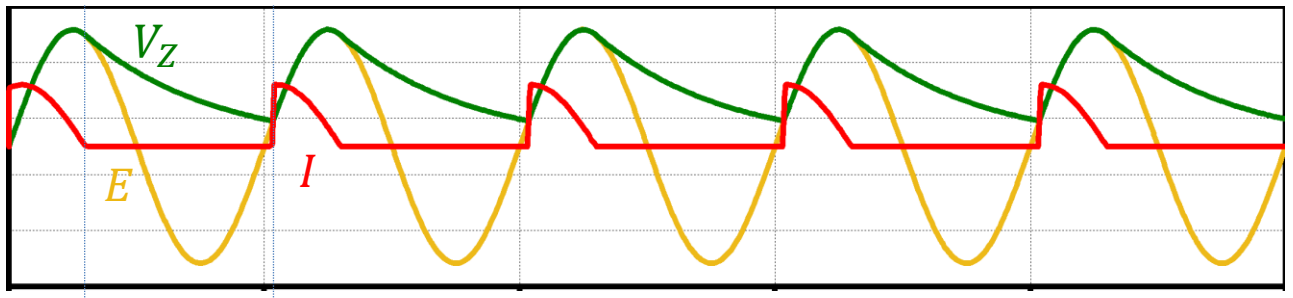
＜電流が流れるタイミング＞
$E > V_Z$が成り立つタイミング

V_ZがDC電圧に近づくと電流が流れる
時間が短くなる

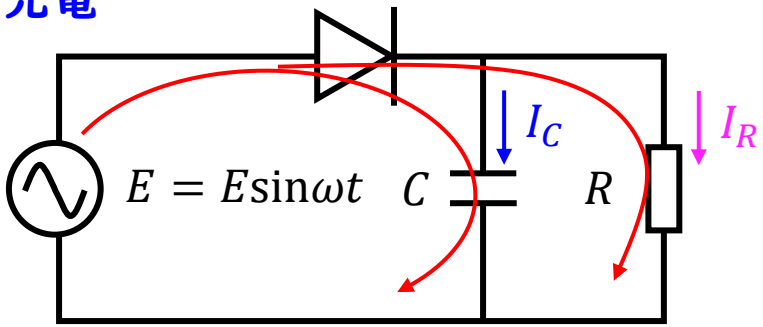


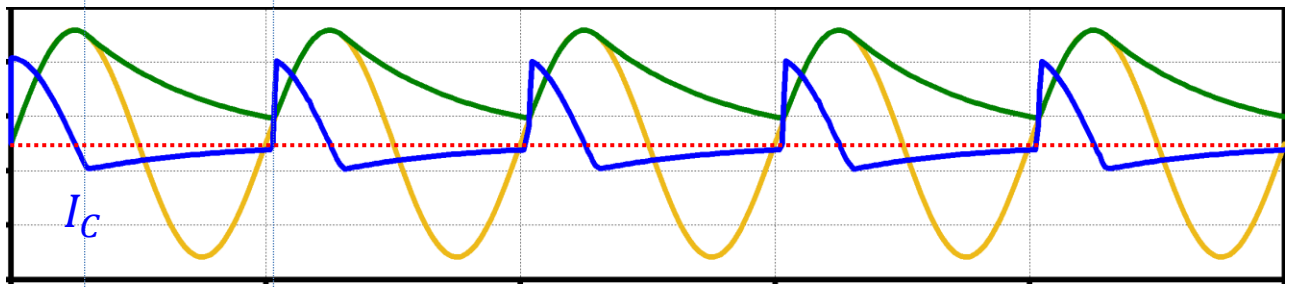
半波整流回路+コンデンサ



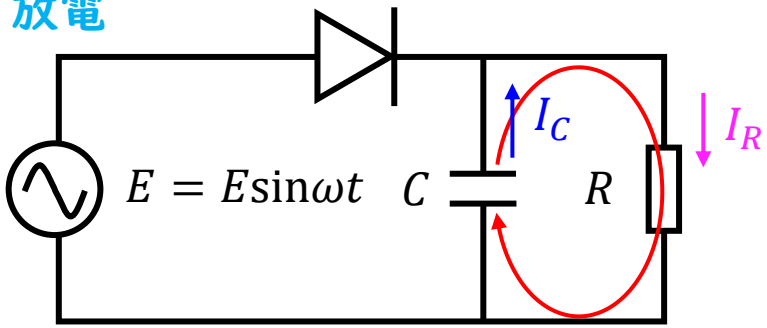


充電

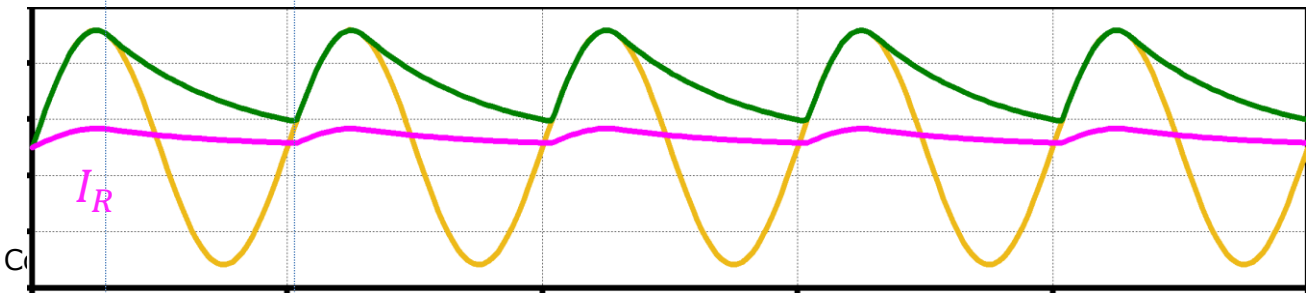




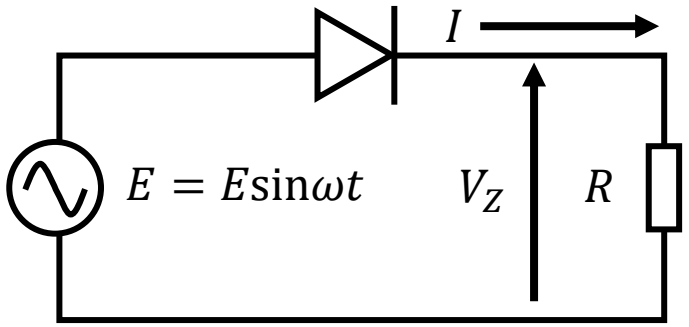
放電

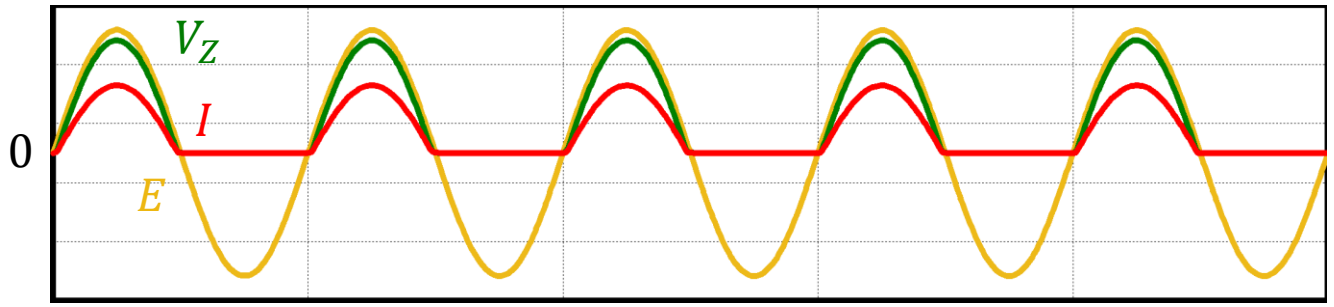


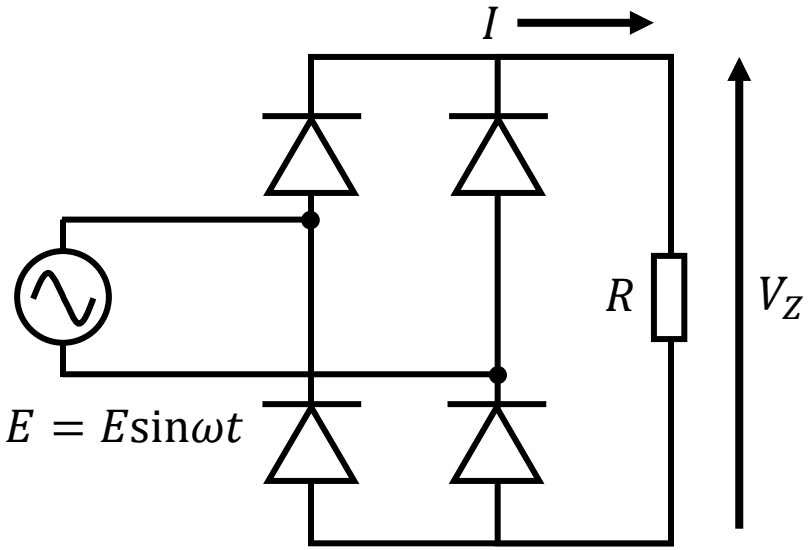
充電　放電

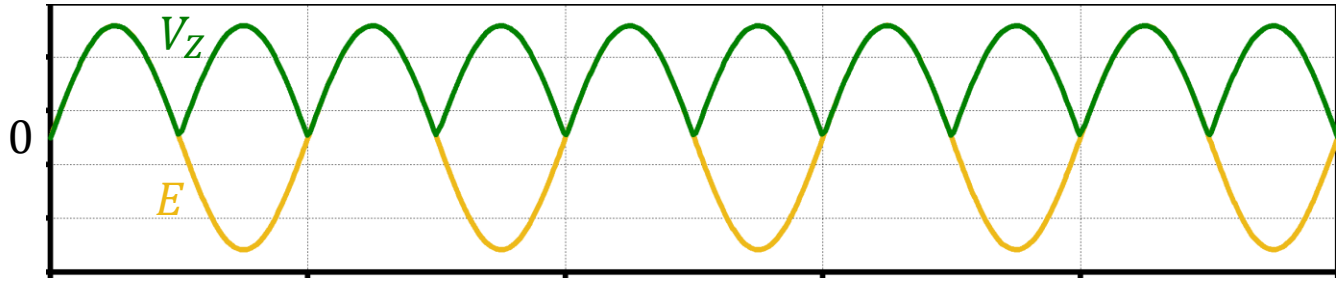


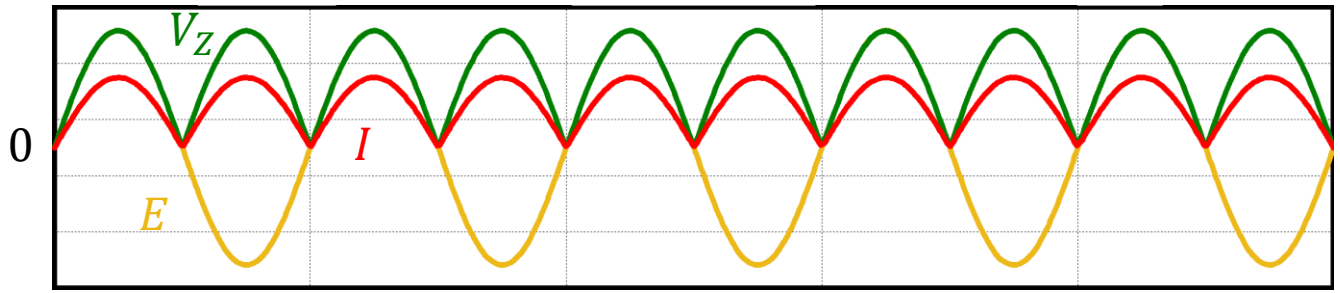
全波整流回路



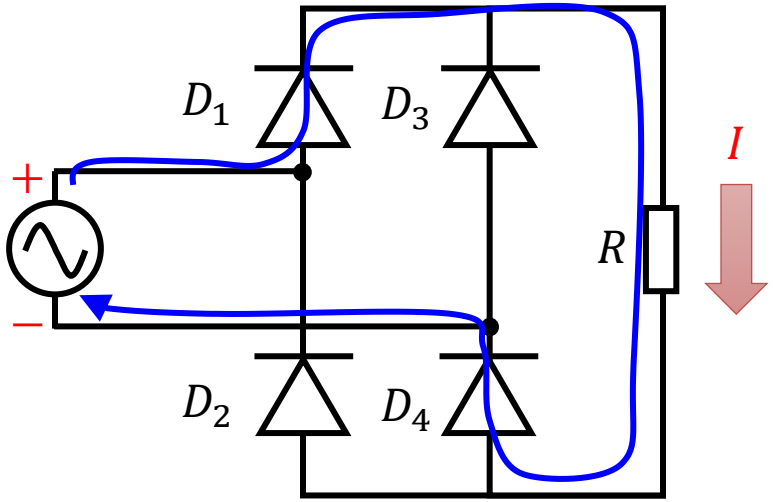


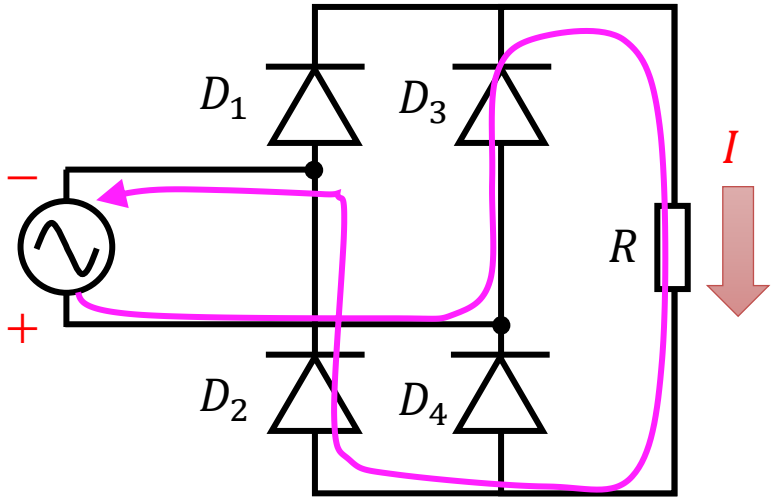


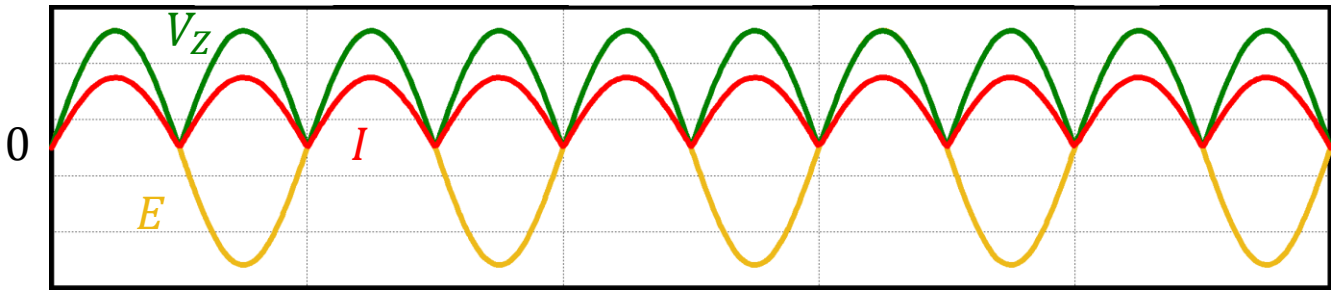


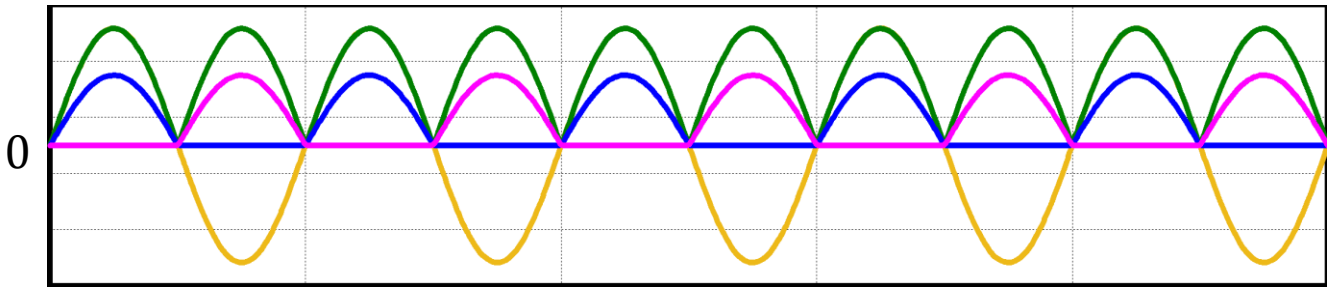


全波整流回路





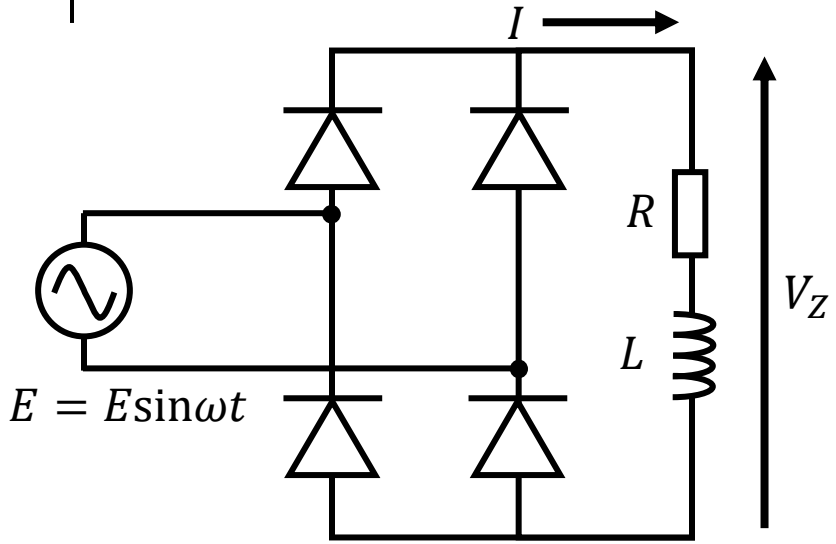


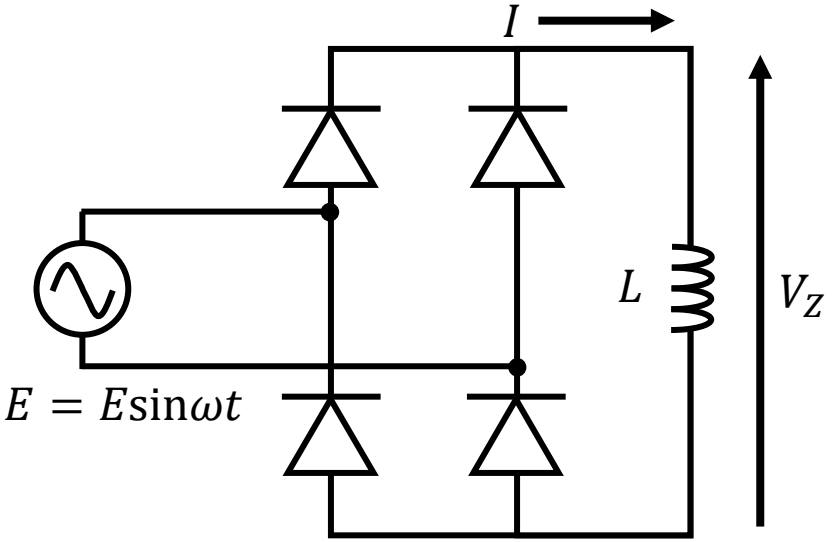


I_{D1}, I_{D4}　I_{D2}, I_{D3}

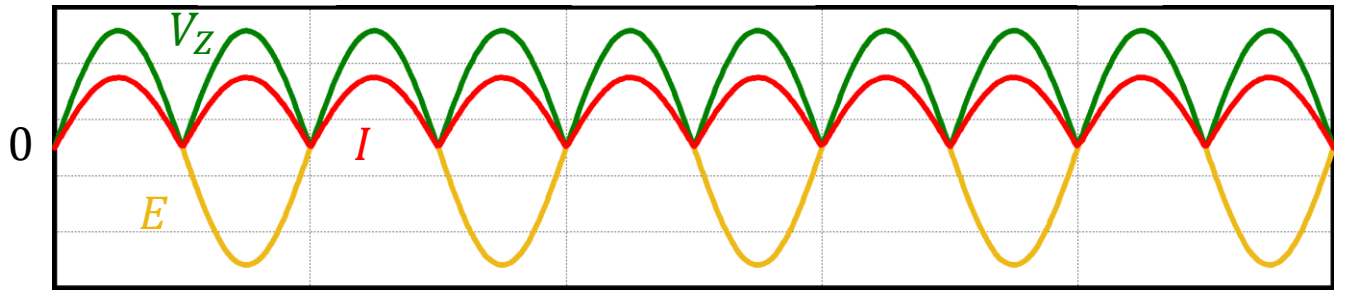
電源電圧の向きに応じてD_1 , D_4またはD_2 , D_3がONとなる。
電圧の向きによらず、負荷には同じ向きの電流が流れ続ける。

全波整流回路

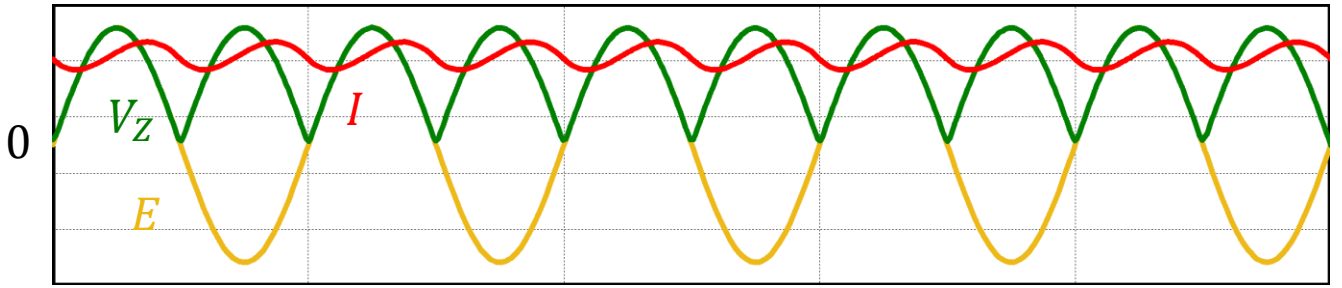




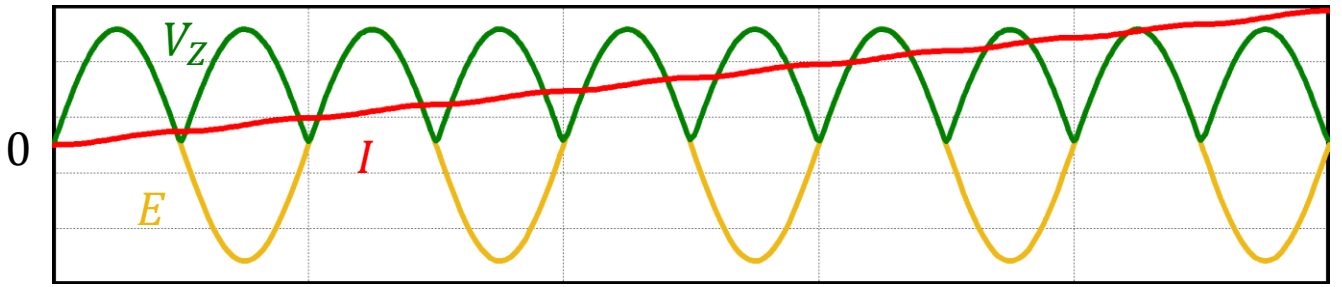
$R,\quad L = 0$



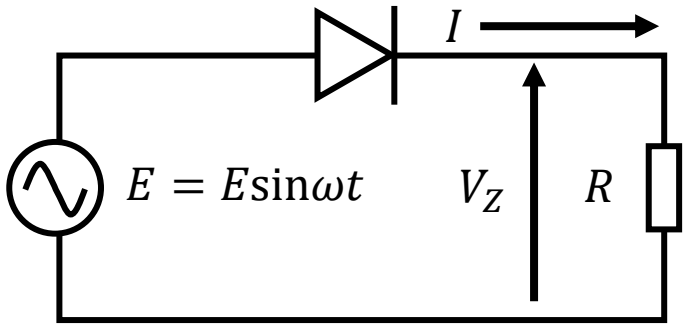
$R,\quad L$

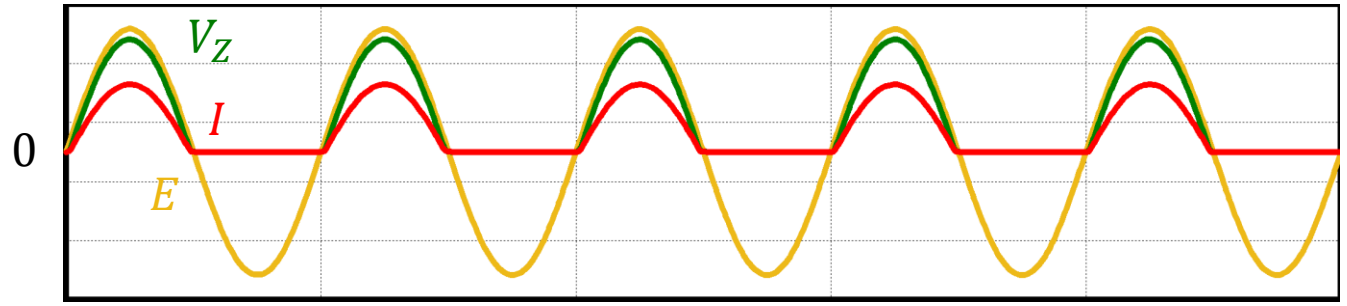


$R = 0\ , L$

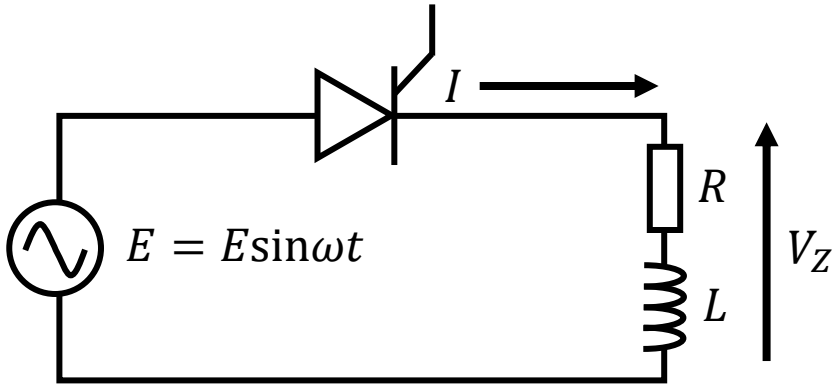


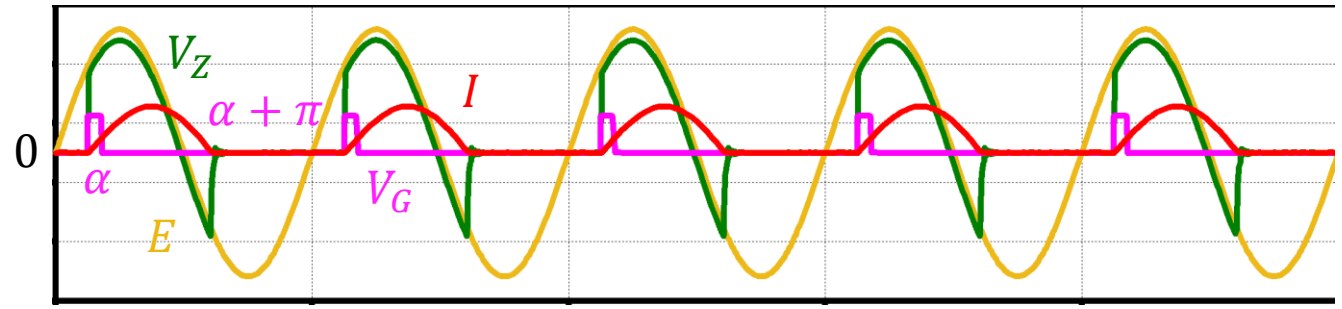
波形と公式





$$V_{Zave} = \frac{2}{\pi}E = \frac{2\sqrt{2}}{\pi}E_{rms}$$





$$V_{Zave} = \frac{2}{\pi}E\cos\alpha = \frac{2\sqrt{2}}{\pi}E_{rms}\cos\alpha$$

ご聴講はありがとうございました!!