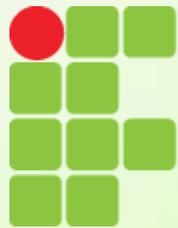
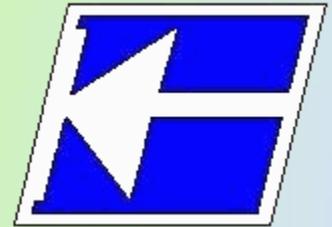


Instituto Federal de Educação, Ciência e Tecnologia de Santa Catarina



**INSTITUTO FEDERAL
SANTA CATARINA**

**Departamento Acadêmico de Eletrônica
Eletrônica Básica e Projetos Eletrônicos**



Retificadores de Meia Onda e Onda Completa

Prof. Clóvis Antônio Petry.

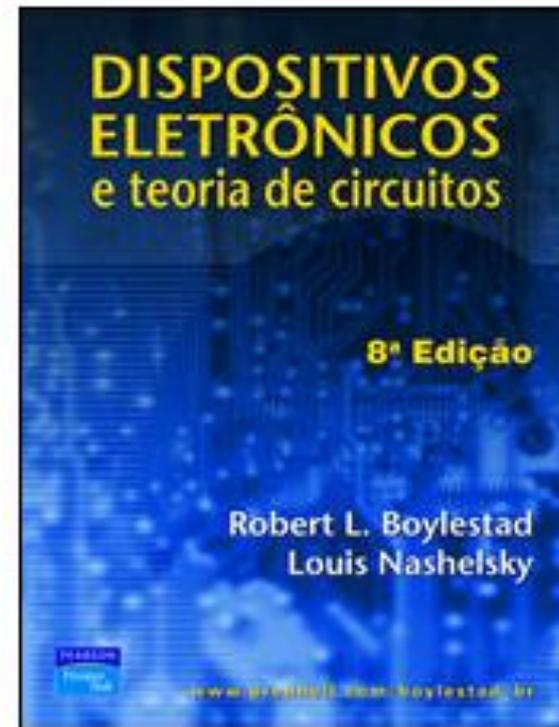
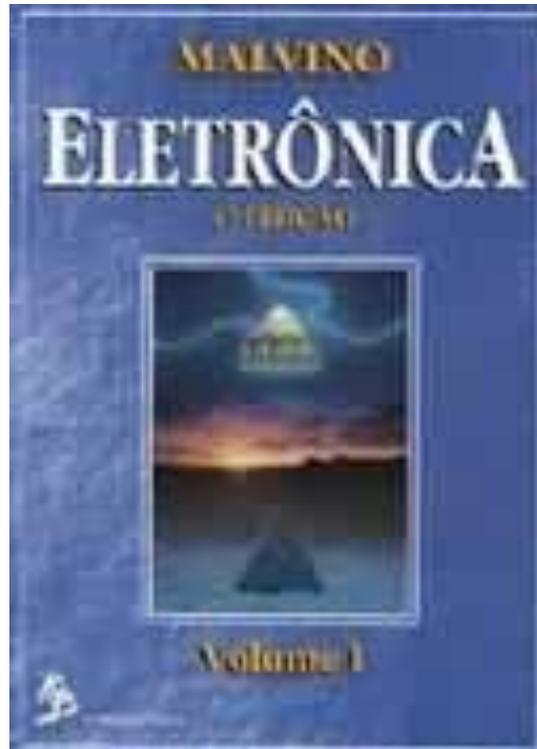
Florianópolis, março de 2009.

Nesta aula

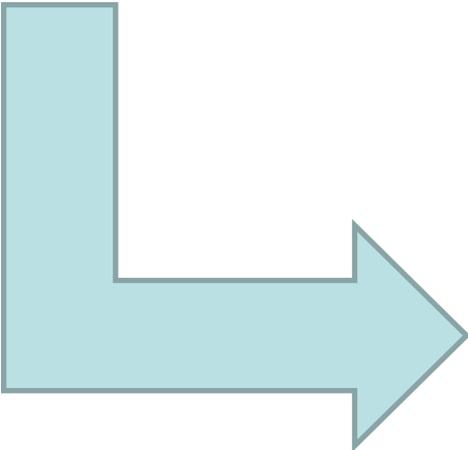
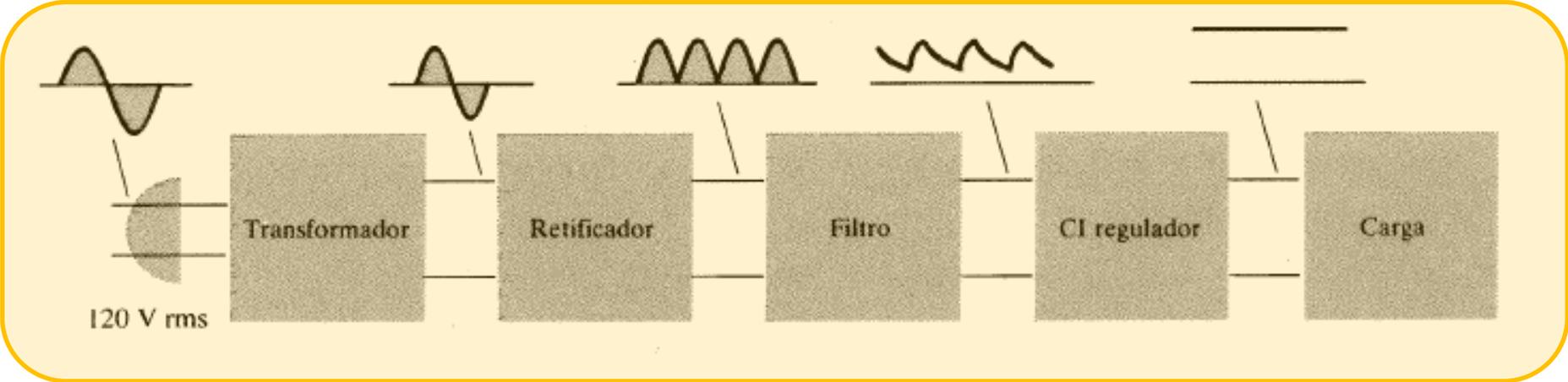
Seqüência de conteúdos:

1. Retificador de meia onda;
2. Retificador de onda completa em ponte;
3. Retificador de onda completa com derivação central;
4. Retificador de onda completa em ponte simétrico.

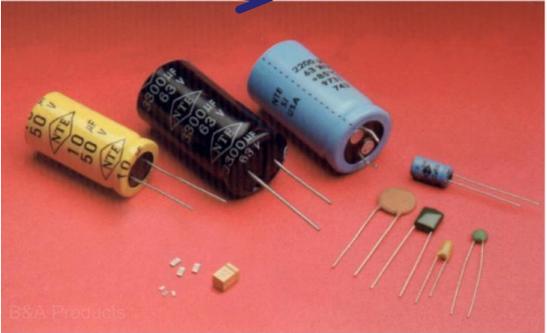
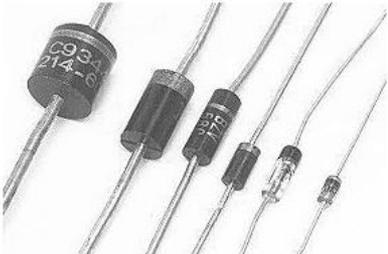
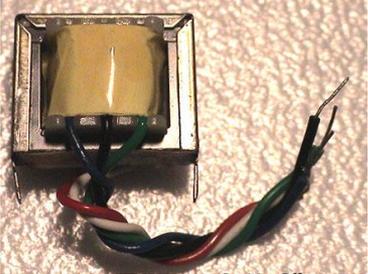
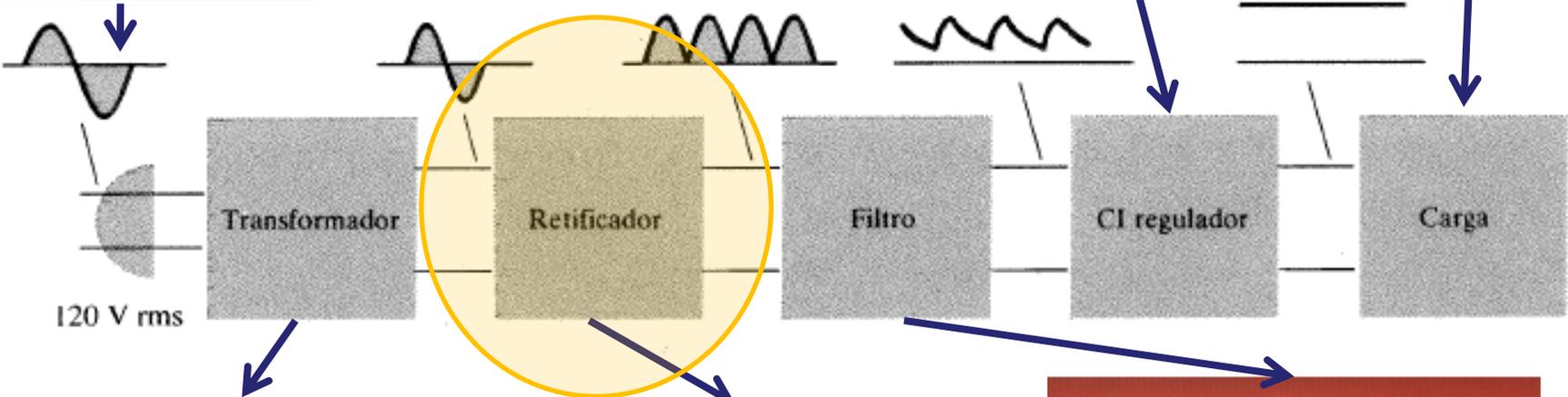
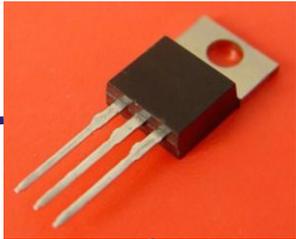
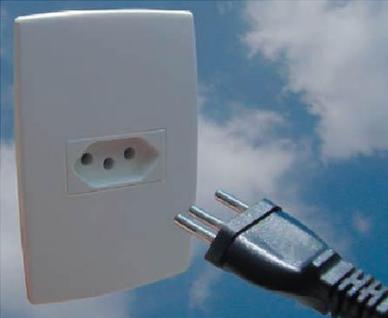
Bibliografia



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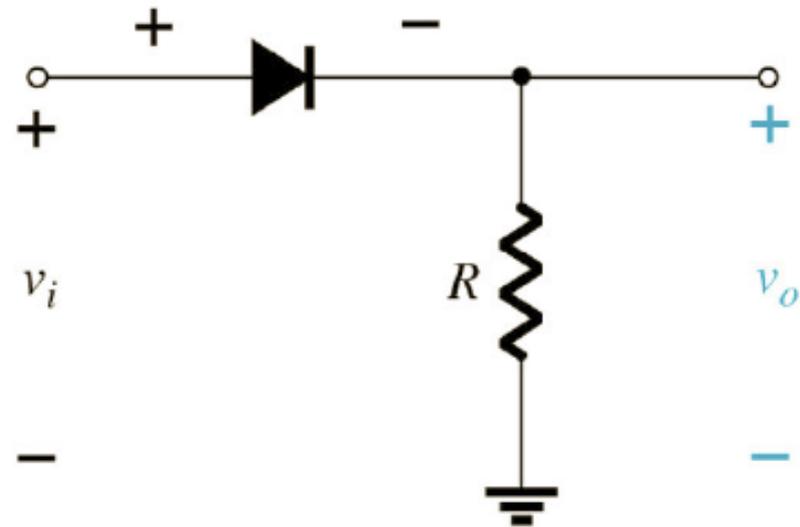
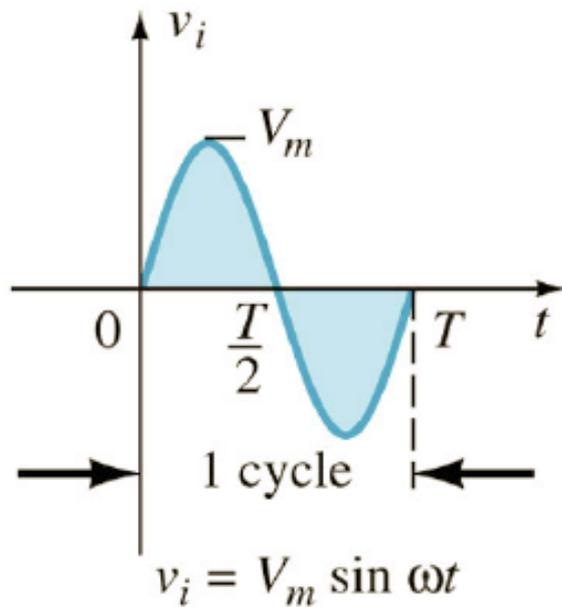


Fonte Linear



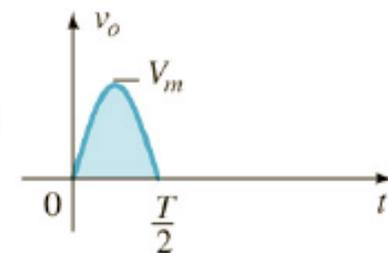
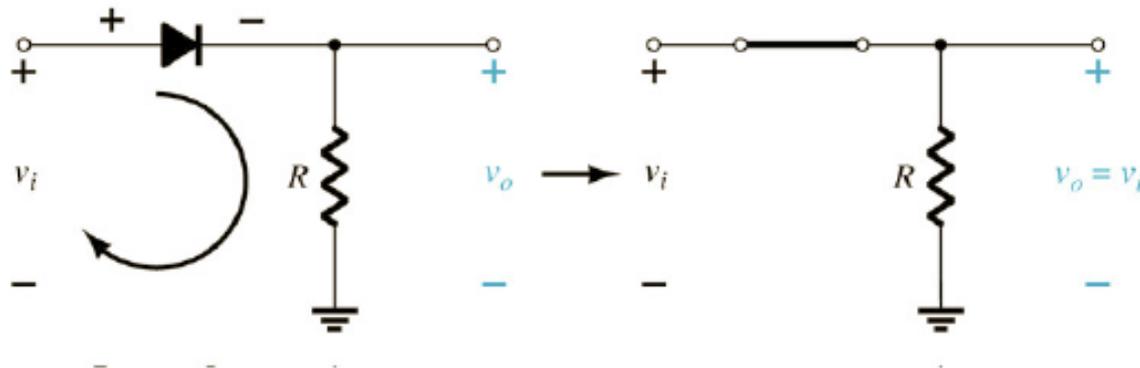
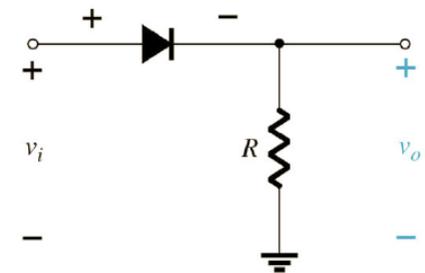
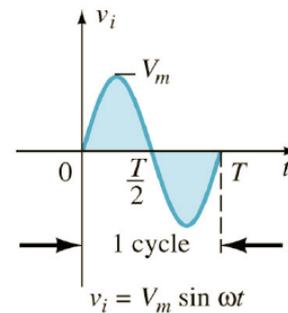
Retificador de meia onda

Circuito simples para análise:



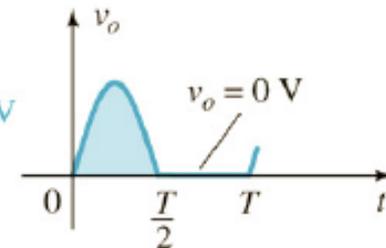
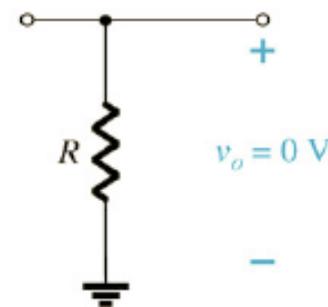
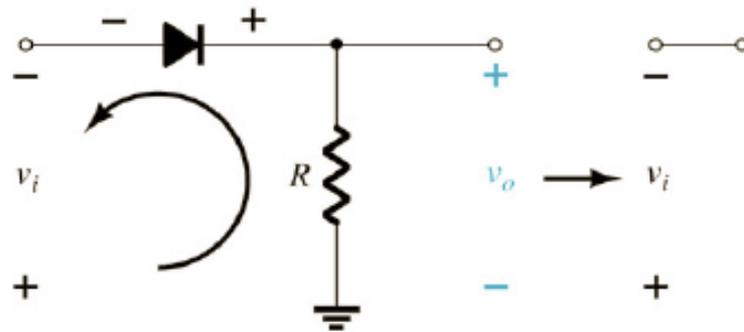
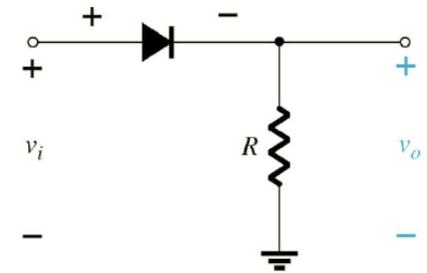
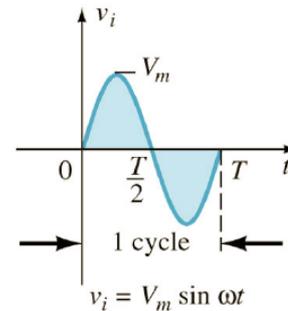
Retificador de meia onda

Região de condução (0 até $T/2$):



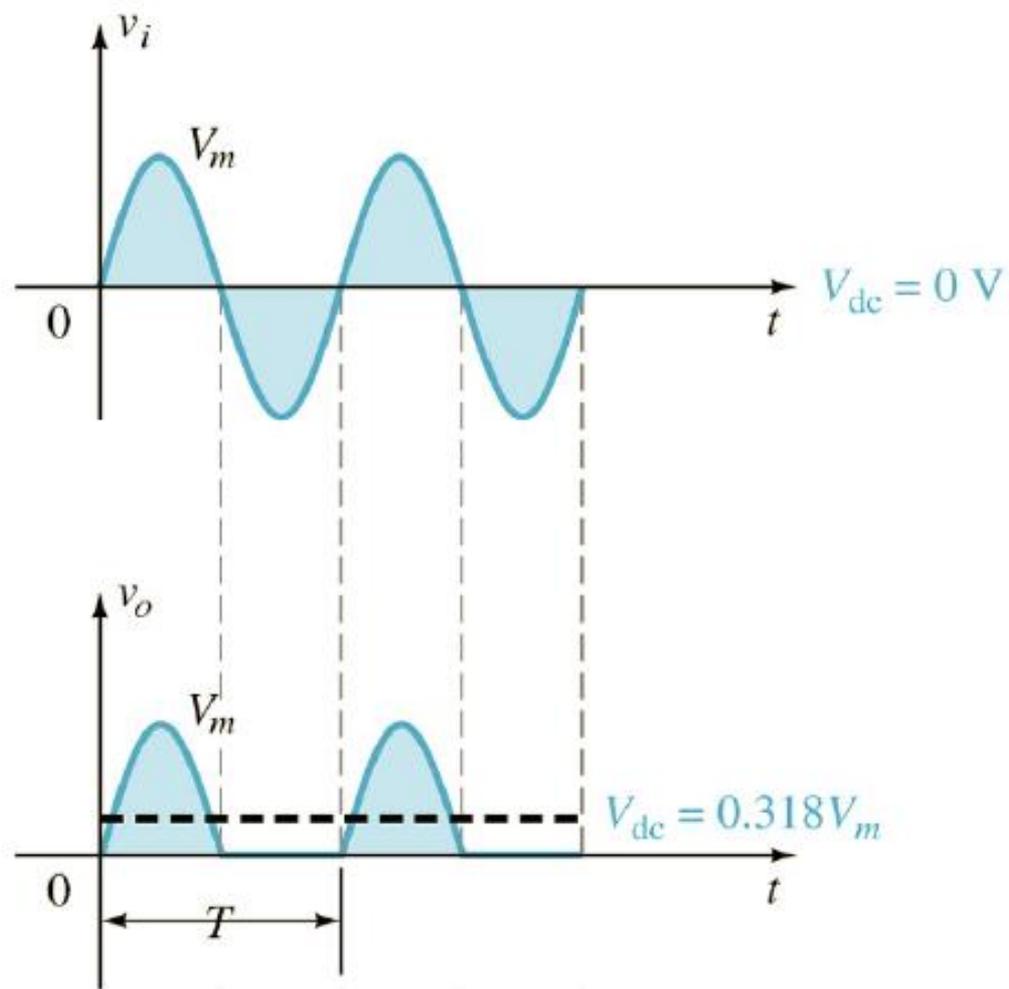
Retificador de meia onda

Região de não-condução ($T/2$ até T):

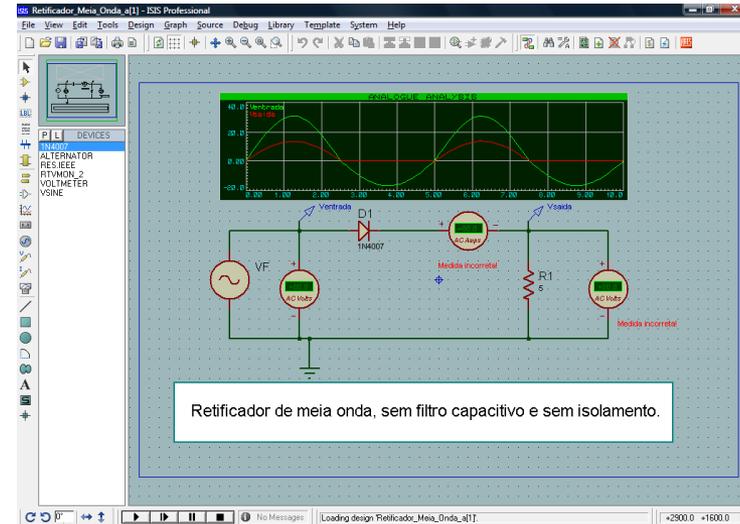
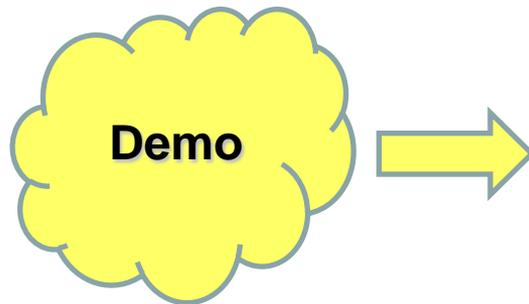


Retificador de meia onda

Forma de onda resultante:



Retificador de meia onda

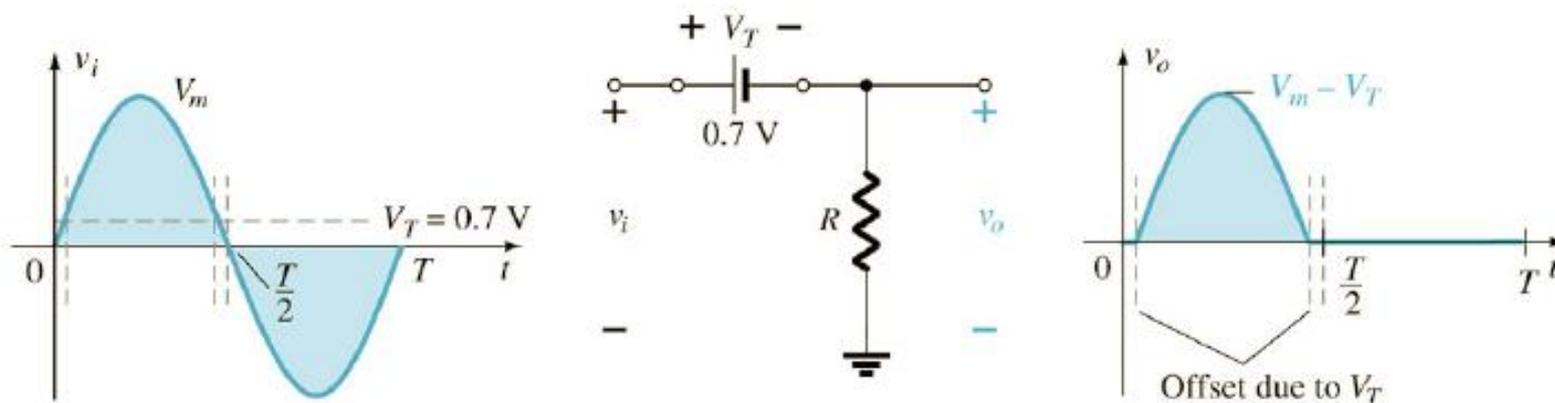


Demo:

- Princípio de funcionamento.

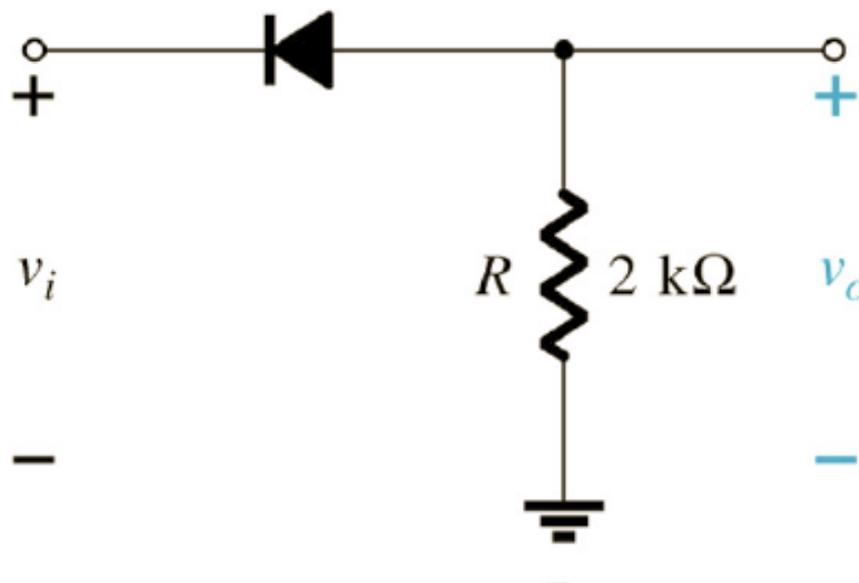
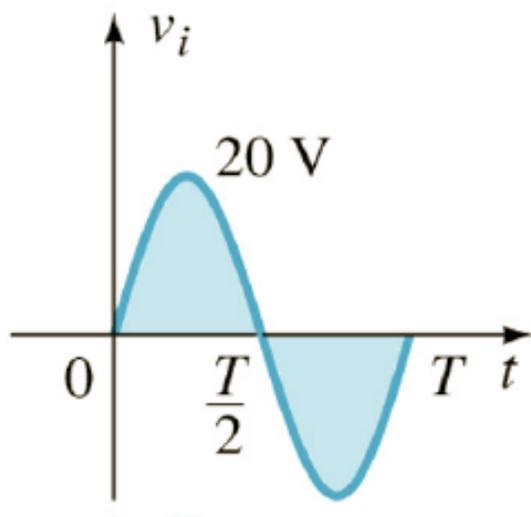
Retificador de meia onda

Efeito da queda de tensão direta do diodo:



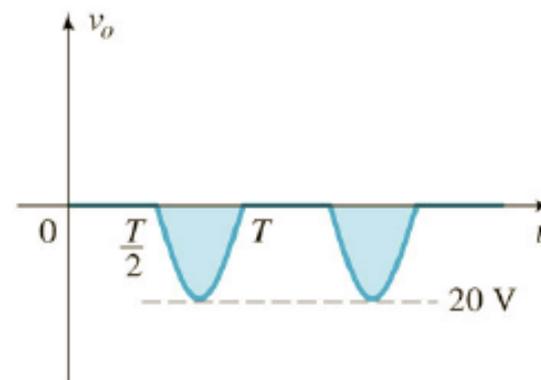
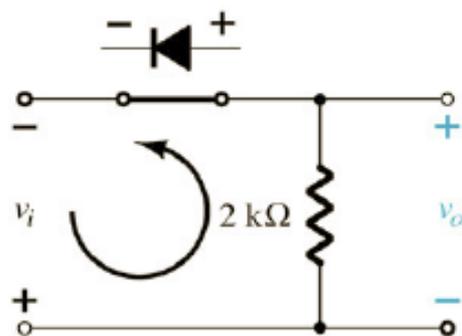
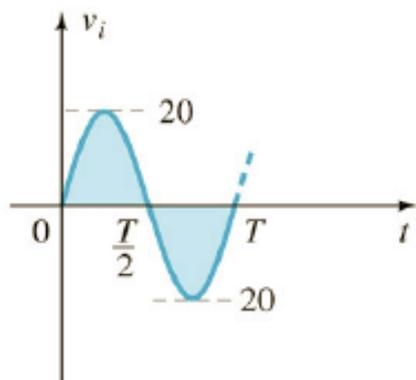
Retificador de meia onda

Analizando um circuito modificado:



Retificador de meia onda

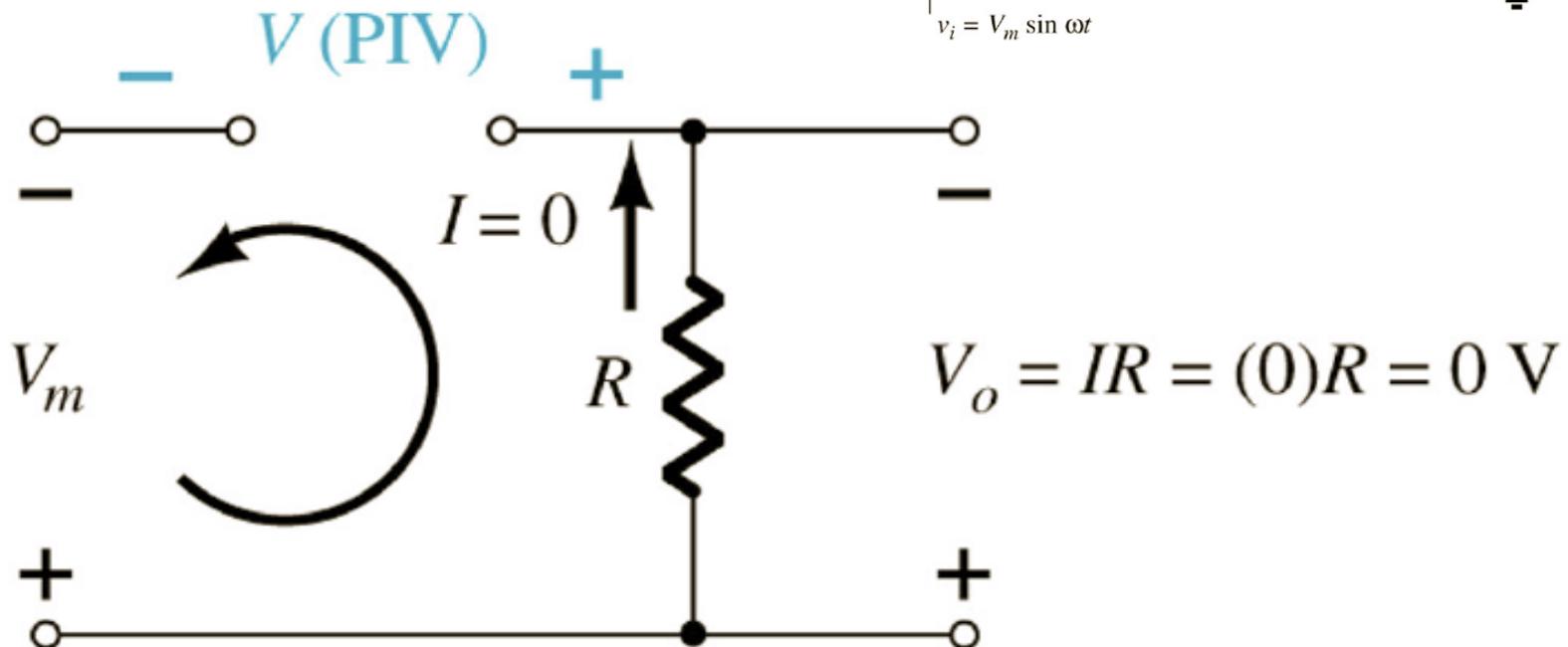
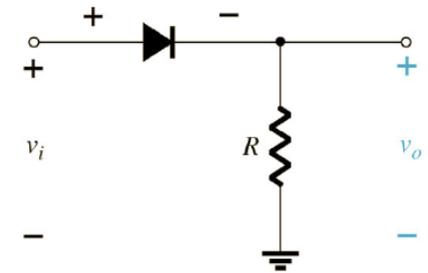
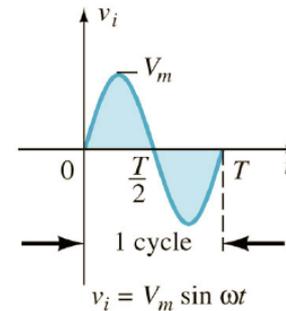
Analizando um circuito modificado:



Retificador de meia onda

Determinando a tensão máxima reversa:

$$V_{RRM} = V_m$$



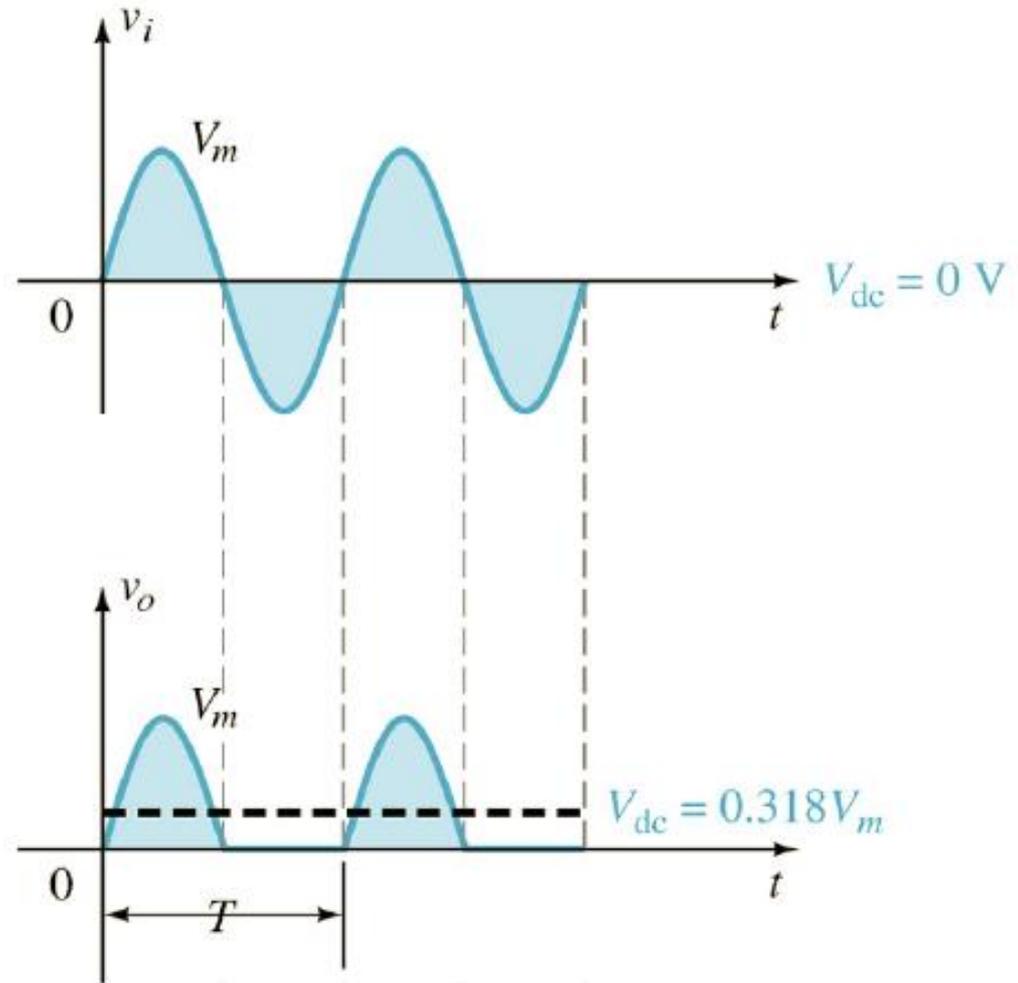
Retificador de meia onda

Determinando a tensão média de saída:

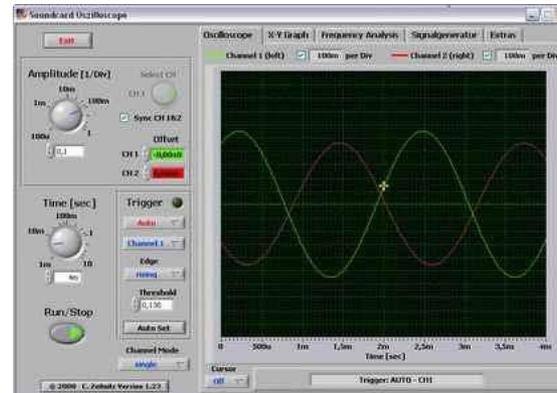
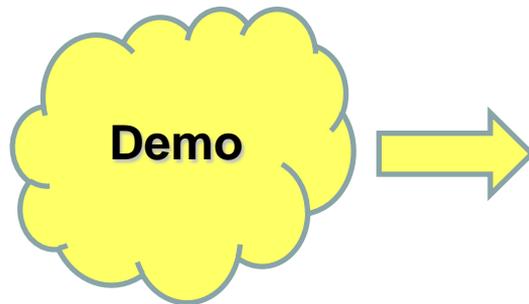
$$V_{med} = \frac{1}{T} \int_0^{T/2} V_m \cdot \text{sen}(t) \cdot dt$$

$$V_{med} = \frac{V_m}{\pi}$$

$$V_{med} = 0,318 \cdot V_m$$



Retificador de meia onda

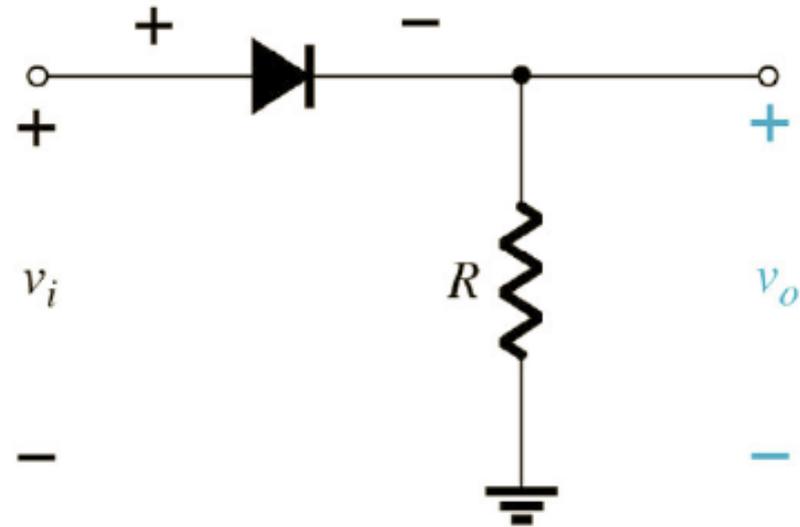
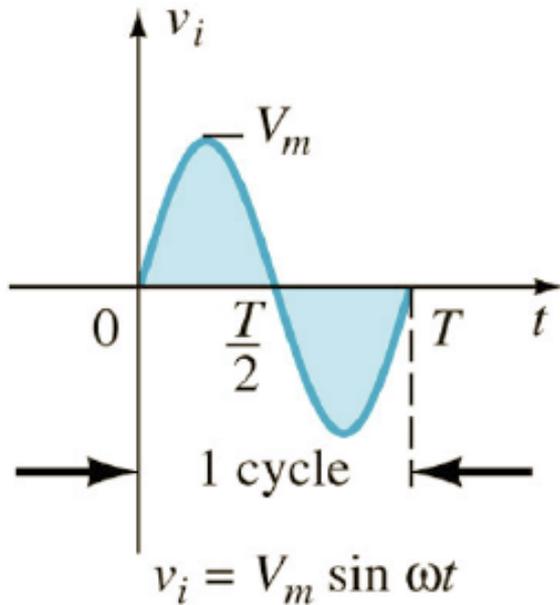


Demo:

- Retificador de meia onda;
- Tensão média na saída;
- Tensão reversa no diodo.

Retificador de meia onda

Considerando o circuito abaixo:



Considerando os dados ao lado, determine:

- Tensão média na saída;
- Tensão de pico na saída;
- Tensão reversa sobre o diodo;
- Corrente média na saída.

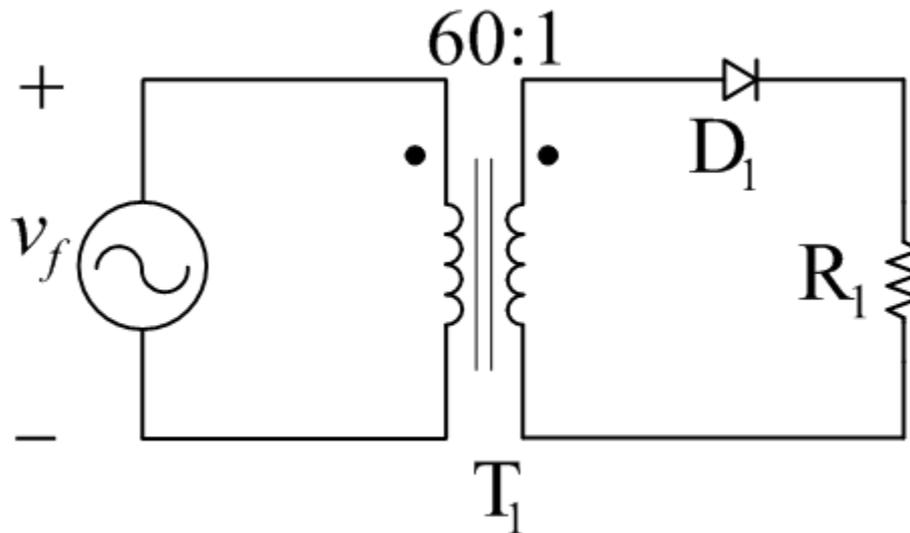
$$V_m = 10 \text{ V};$$

$$R = 5 \Omega;$$

$$D = \textit{ideal}.$$

Retificador de meia onda

Considerando o circuito abaixo:



Considerando os dados ao lado, determine:

- Tensão eficaz no primário de T_1 ;
- Tensão eficaz no secundário de T_1 ;
- Tensão média na saída;
- Tensão de pico na saída;
- Tensão reversa sobre o diodo;
- Corrente média na saída.

$$v_f(t) = 311 \cdot \text{sen}(377 \cdot t) \text{ V};$$

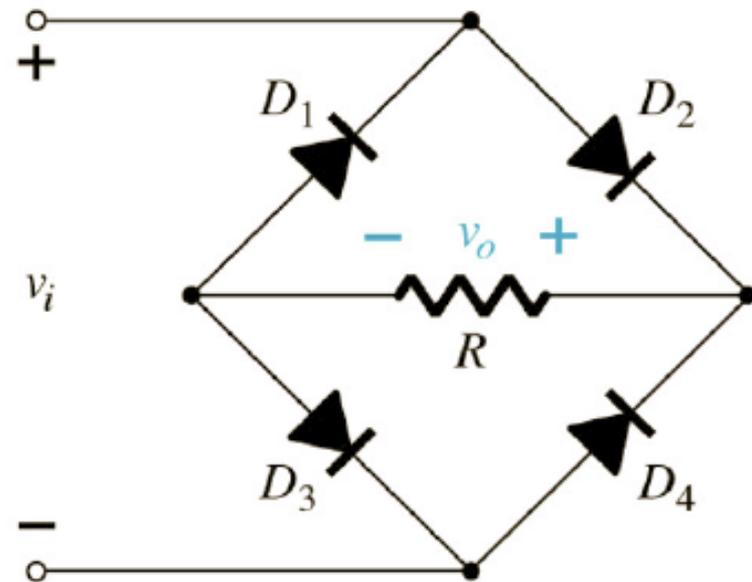
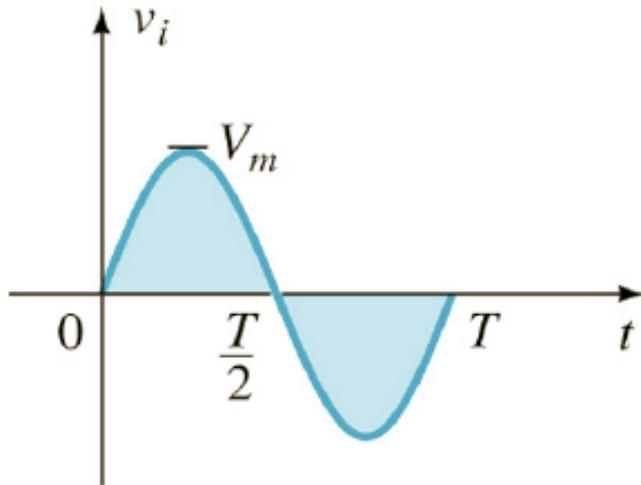
$$R_1 = 5 \Omega;$$

$$D_1 = \textit{ideal};$$

$$T_1 = 60:1.$$

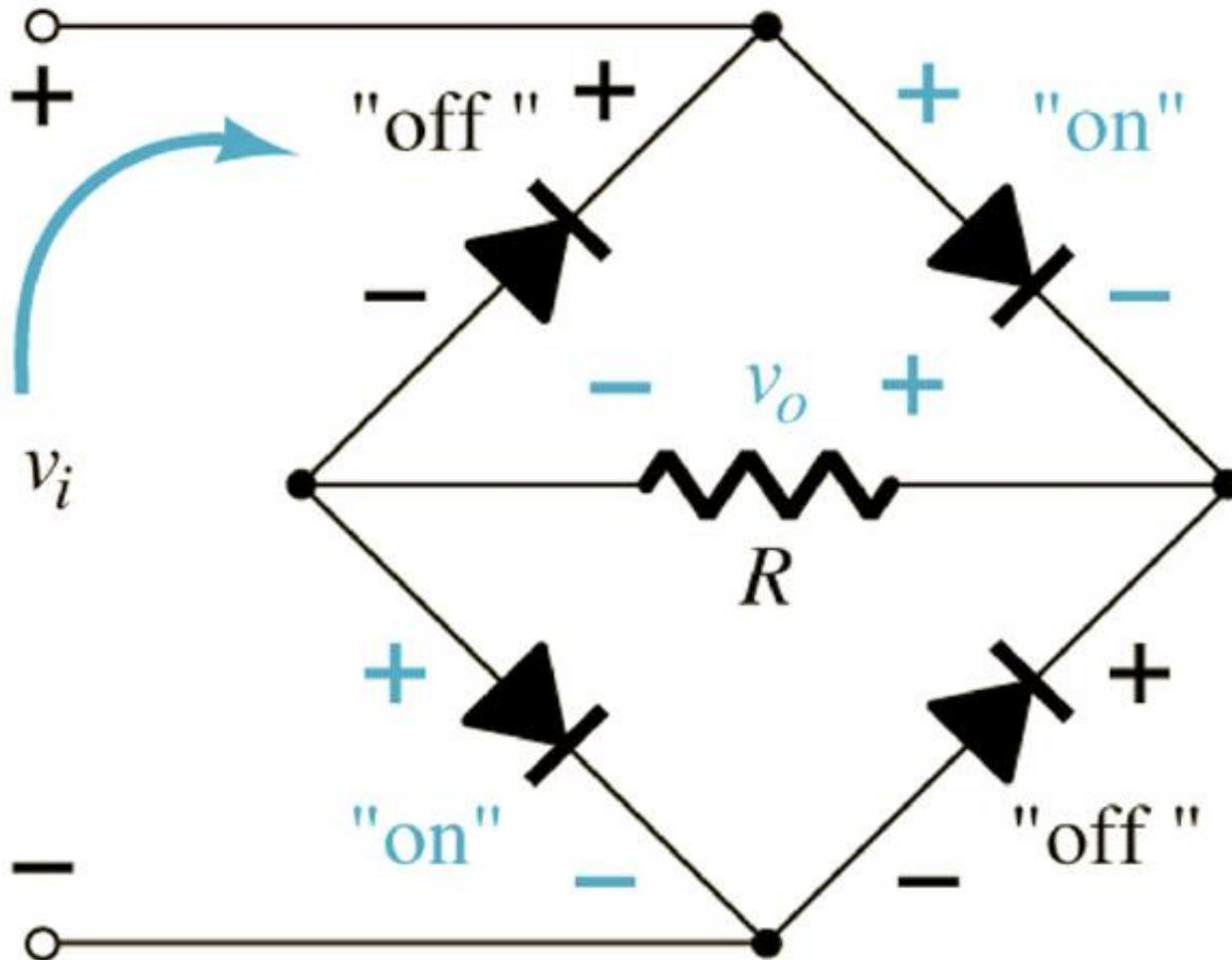
Retificador de onda completa em ponte

Configuração em ponte, circuito para análise:



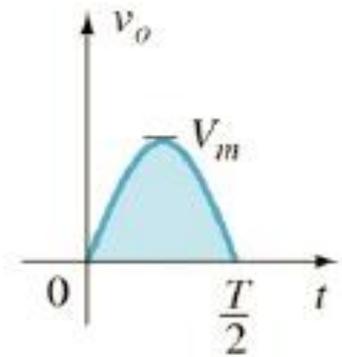
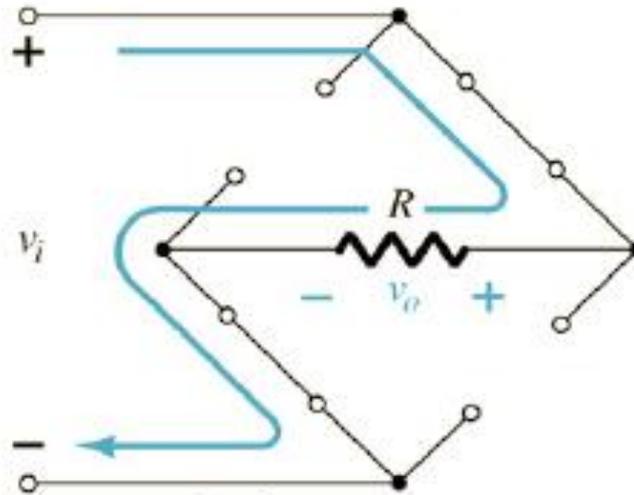
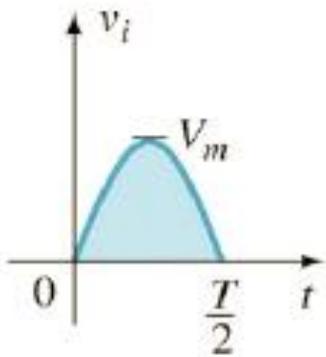
Retificador de onda completa em ponte

Região de condução (0 até $T/2$):



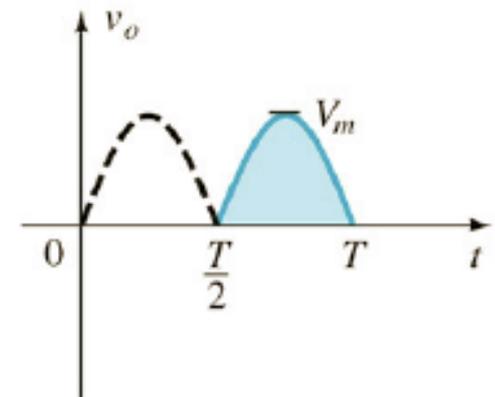
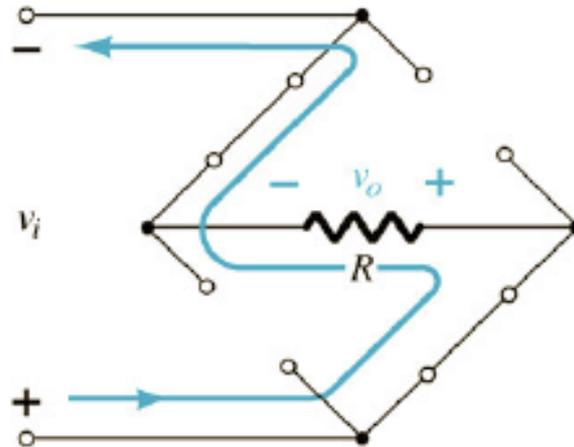
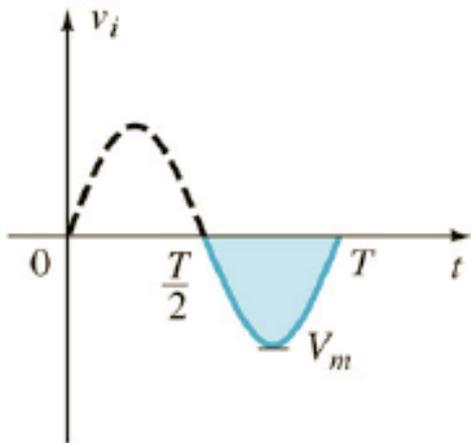
Retificador de onda completa em ponte

Região de condução (0 até $T/2$), caminho da corrente:



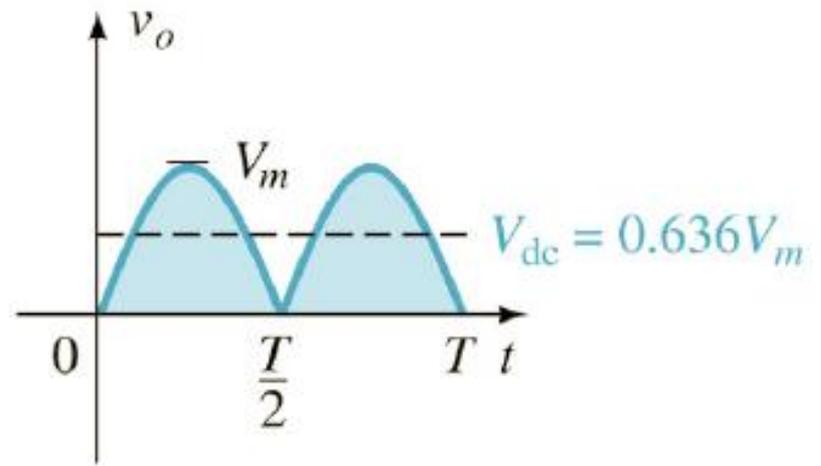
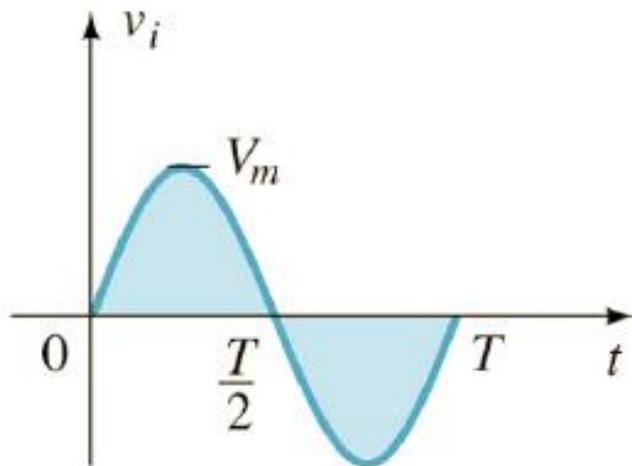
Retificador de onda completa em ponte

Região de condução ($T/2$ até T), caminho da corrente:

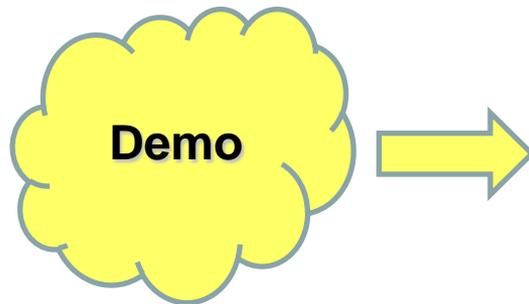


Retificador de onda completa em ponte

Forma de onda resultante:

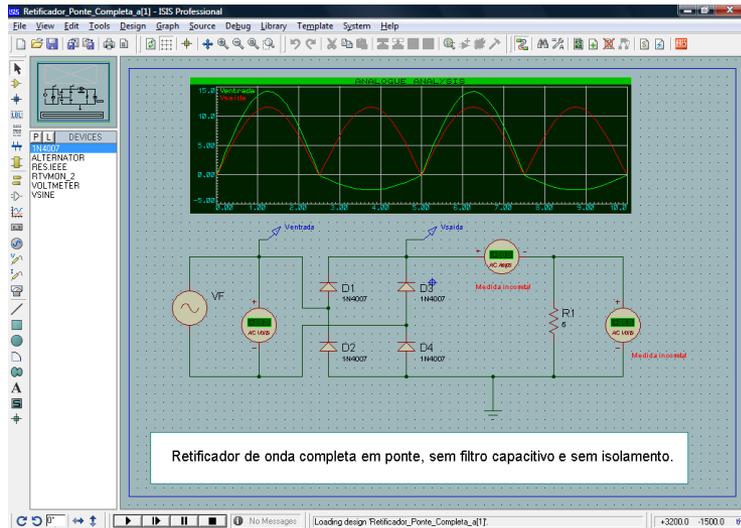


Retificador de onda completa em ponte



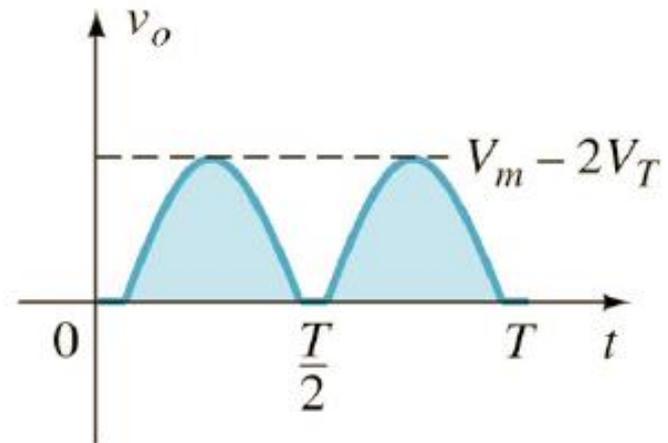
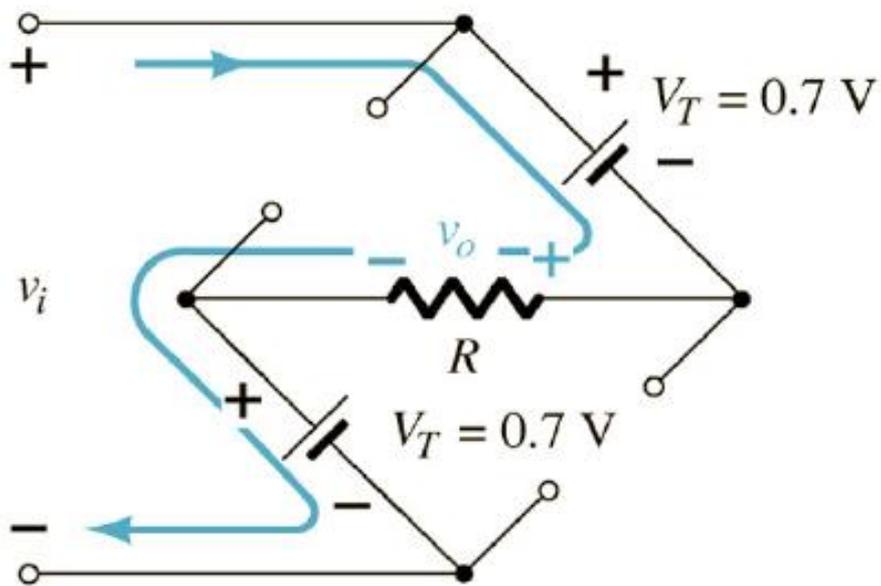
Demo:

- Princípio de funcionamento.



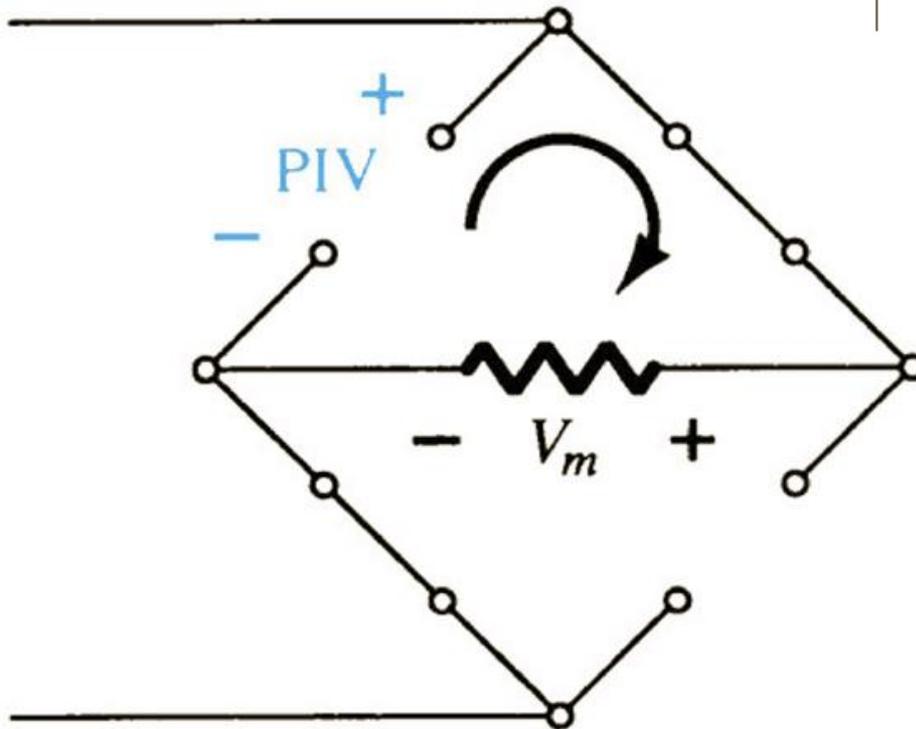
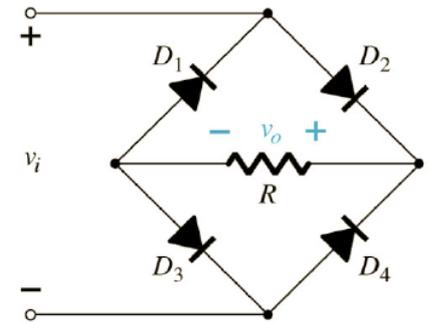
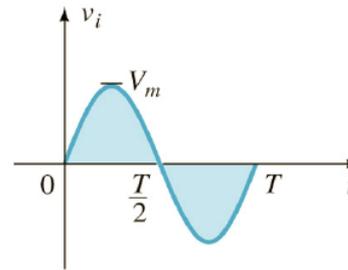
Retificador de onda completa em ponte

Efeito da queda de tensão direta do diodo:



Retificador de onda completa em ponte

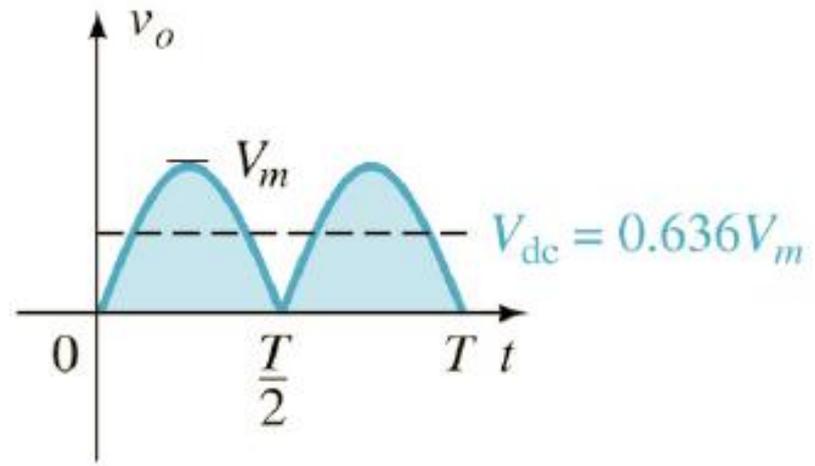
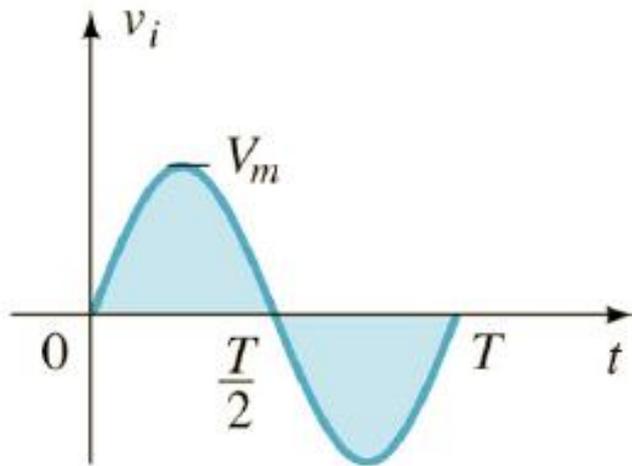
Determinando a tensão máxima reversa:



$$V_{RRM} = V_m$$

Retificador de onda completa em ponte

Determinando a tensão média de saída:

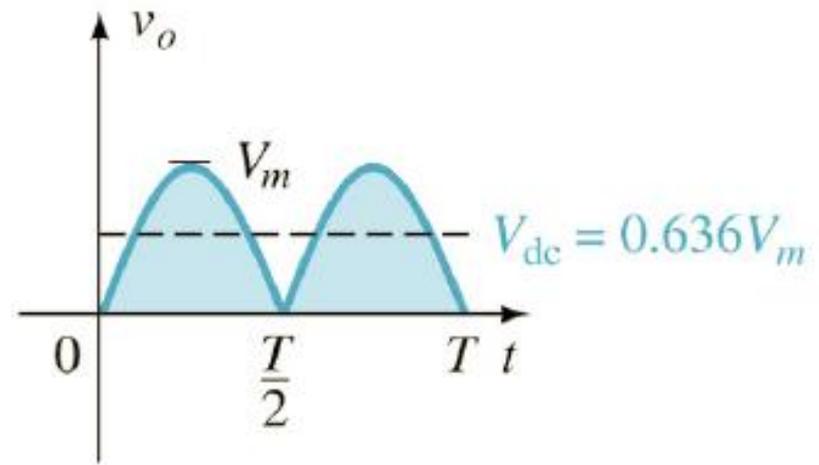
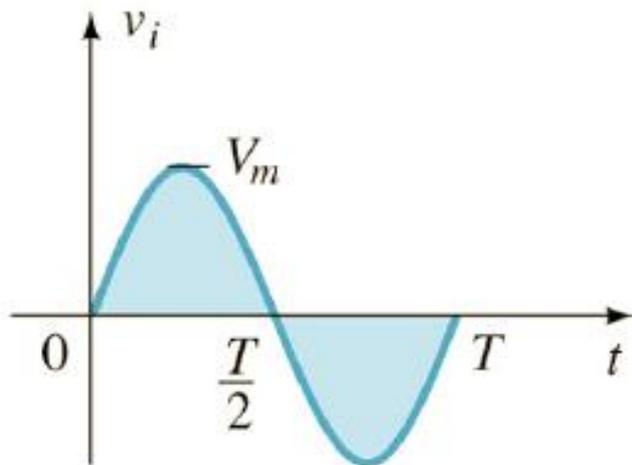


$$V_{med} = \frac{2}{T} \int_0^{T/2} V_m \cdot \text{sen}(t) \cdot dt \longrightarrow V_{med} = \frac{2V_m}{\pi} \longrightarrow V_{med} = 2 \cdot 0,318 \cdot V_m$$

$$V_{med} = 0,636 \cdot V_m$$

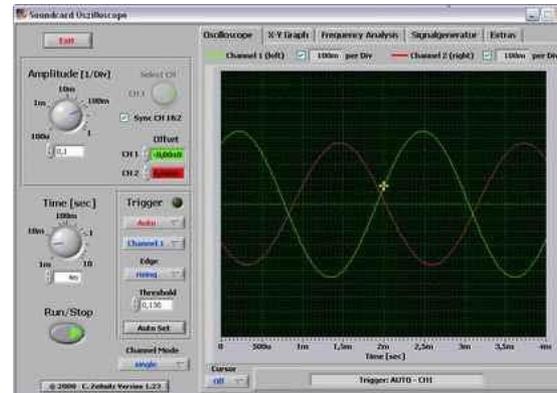
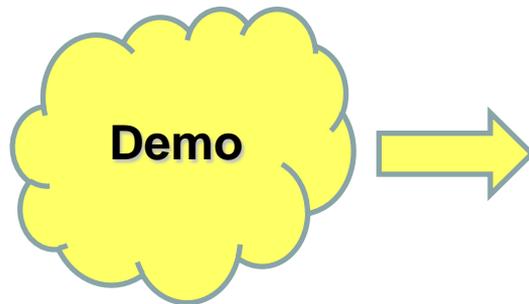
Retificador de onda completa em ponte

Determinando a tensão média de saída para diodos reais:



$$V_{med} = 0,636 \cdot (V_m - 2 \cdot V_T)$$

Retificador de onda completa em ponte

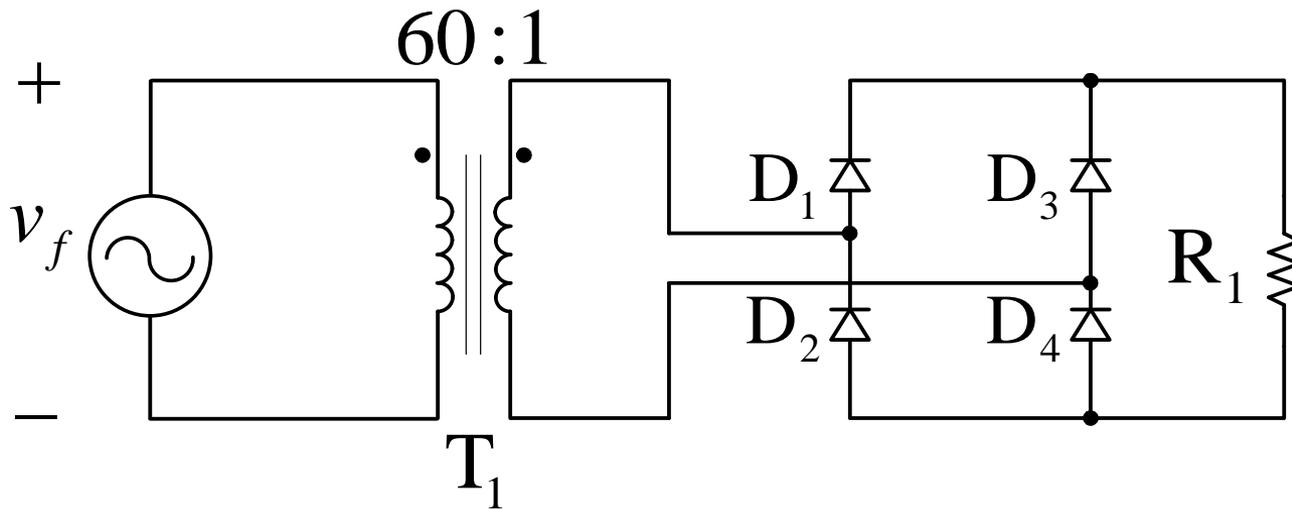


Demo:

- Retificador de onda completa;
- Tensão média na saída;
- Tensão reversa no diodo.

Retificador de onda completa em ponte

Considerando o circuito abaixo:



Considerando os dados ao lado, determine:

- Tensão eficaz no primário de T_1 ;
- Tensão eficaz no secundário de T_1 ;
- Tensão média na saída;
- Tensão de pico na saída;
- Tensão reversa sobre os diodos;
- Corrente média na saída.

$$v_f(t) = 311 \cdot \text{sen}(377 \cdot t) \text{ V};$$

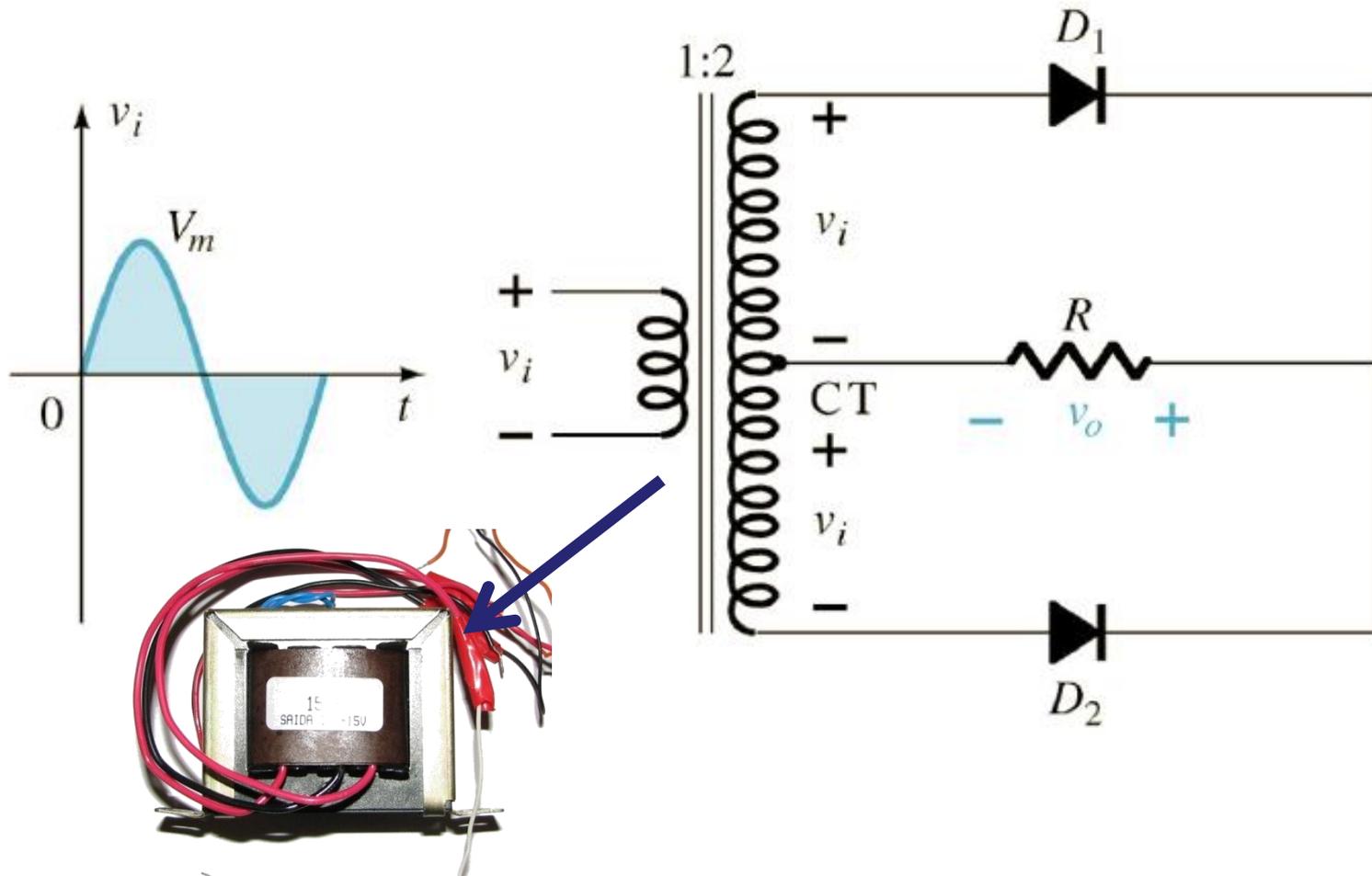
$$R_1 = 5 \Omega;$$

$$D_{1-4} = \textit{ideais};$$

$$T_1 = 60:1.$$

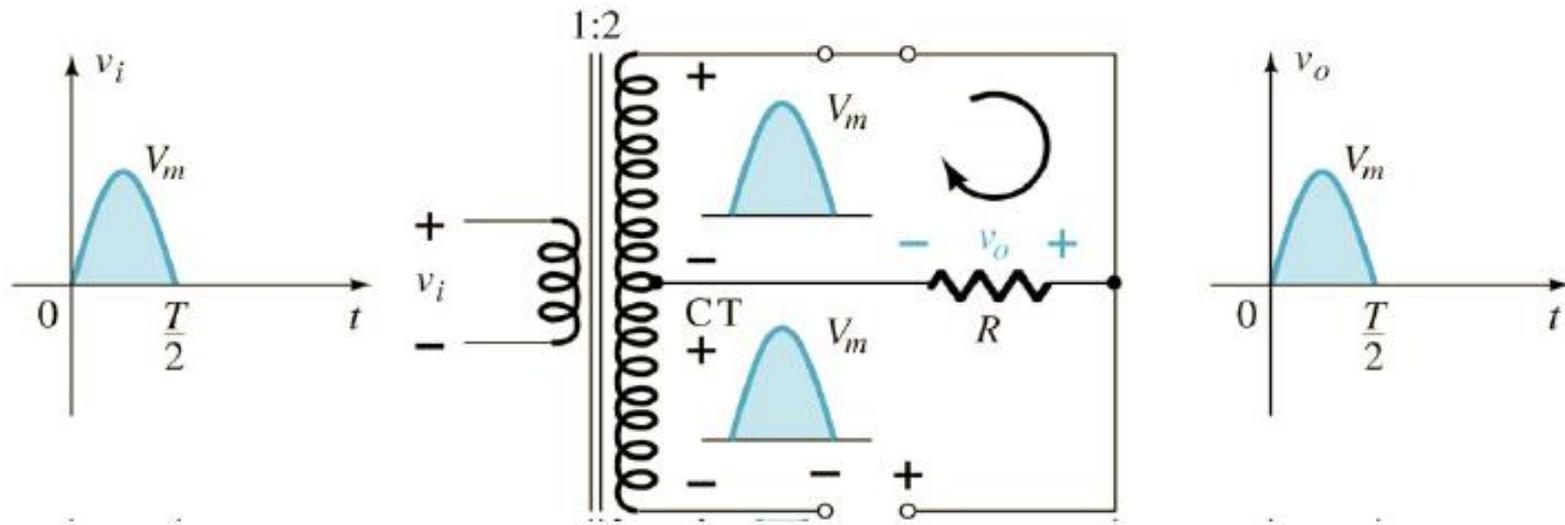
Retificador de onda completa com tap central

Configuração com tap central, circuito para análise:



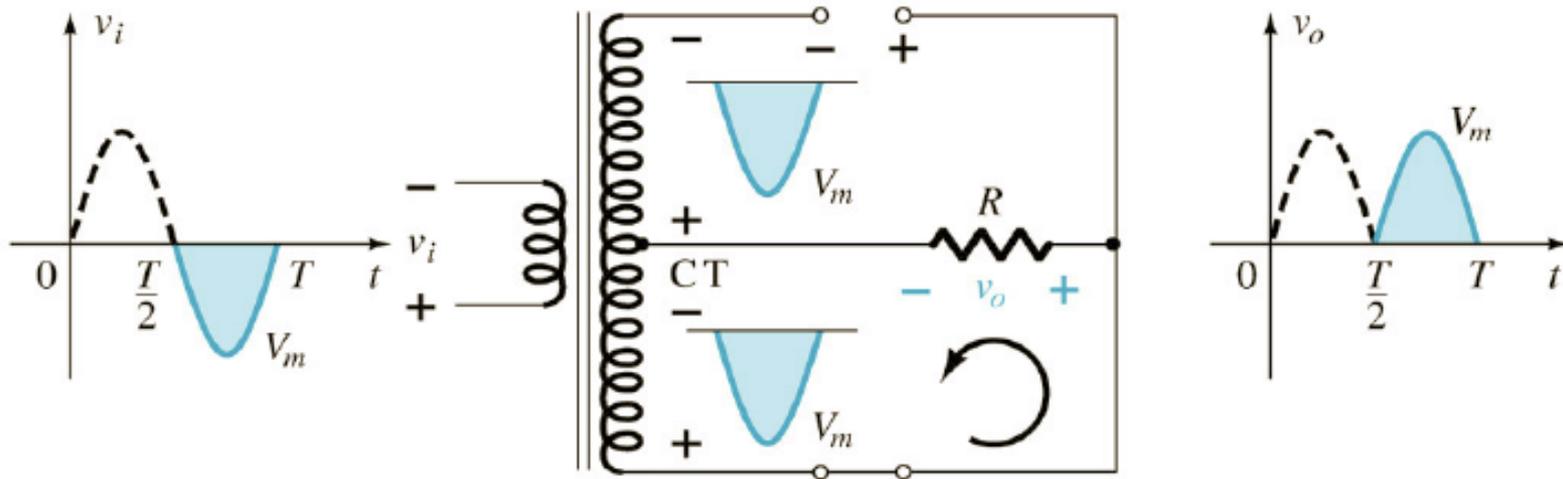
Retificador de onda completa com tap central

Região de condução (0 até $T/2$):

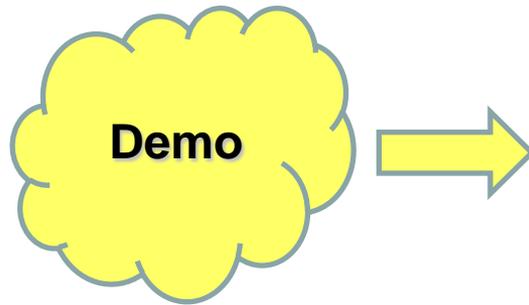


Retificador de onda completa com tap central

Região de condução ($T/2$ até T):

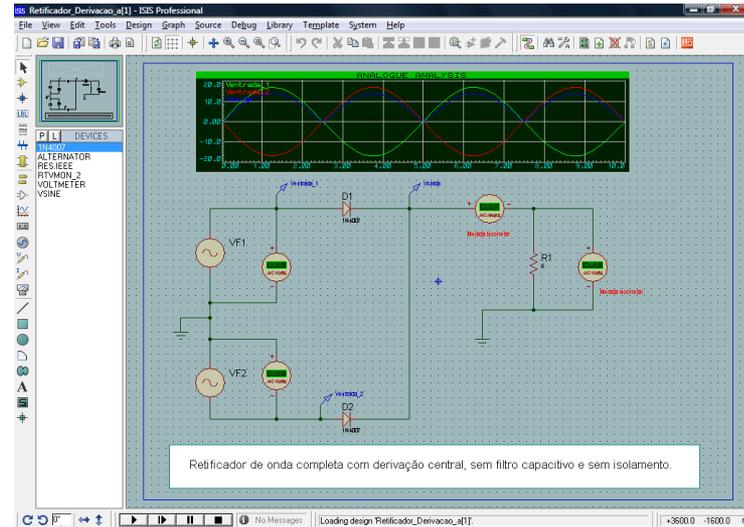


Retificador de onda completa com tap central



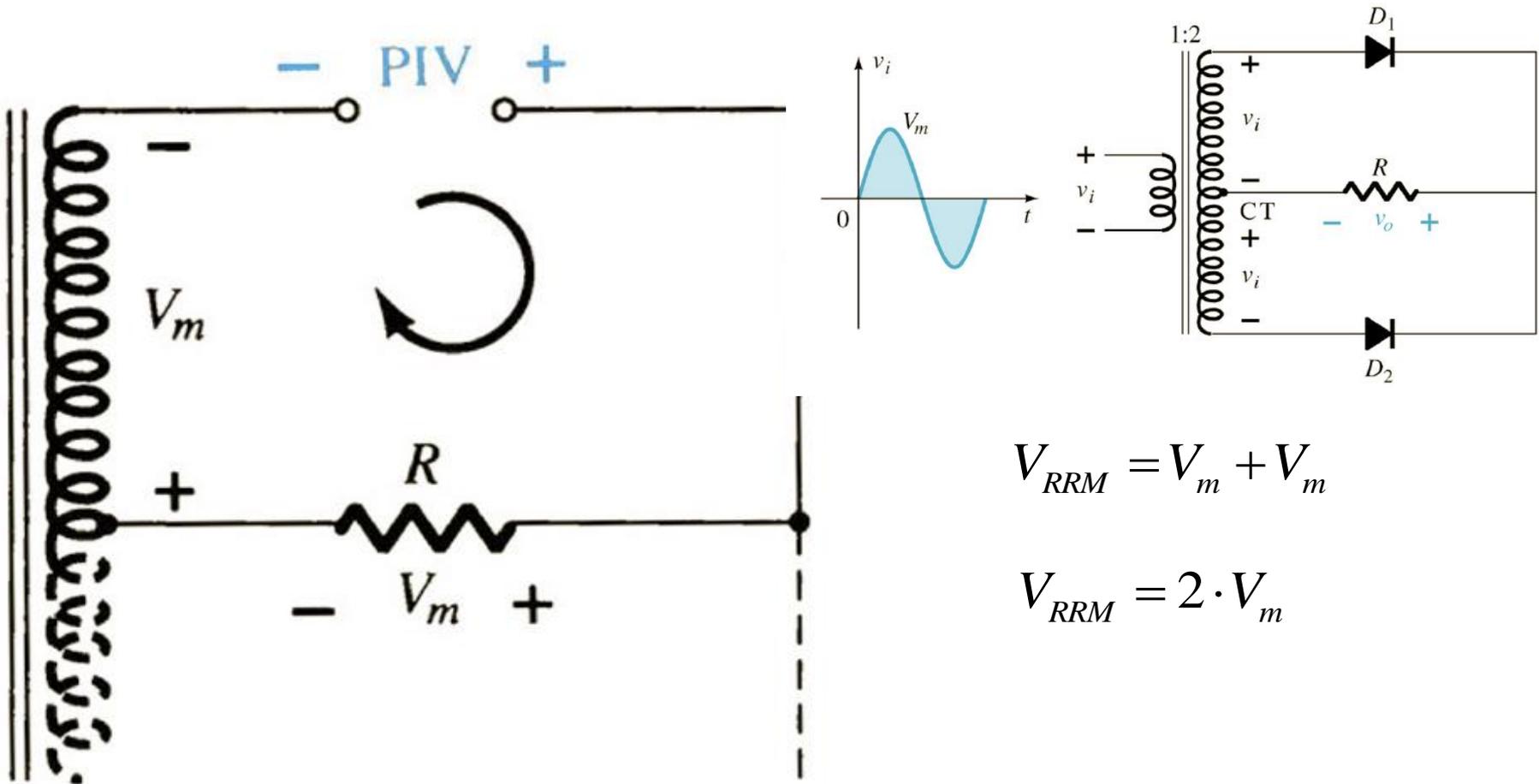
Demo:

- Princípio de funcionamento.



Retificador de onda completa com tap central

Determinando a tensão máxima reversa:

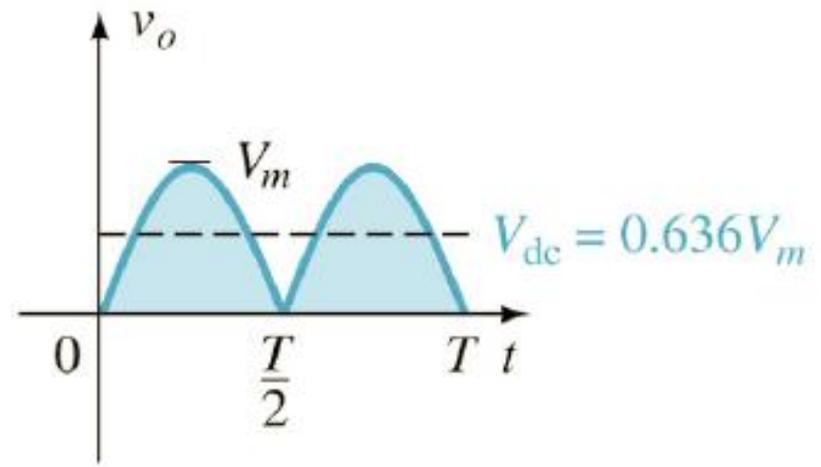
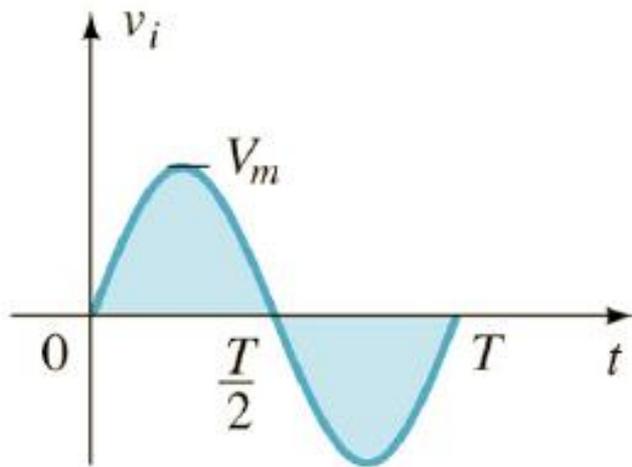


$$V_{RRM} = V_m + V_m$$

$$V_{RRM} = 2 \cdot V_m$$

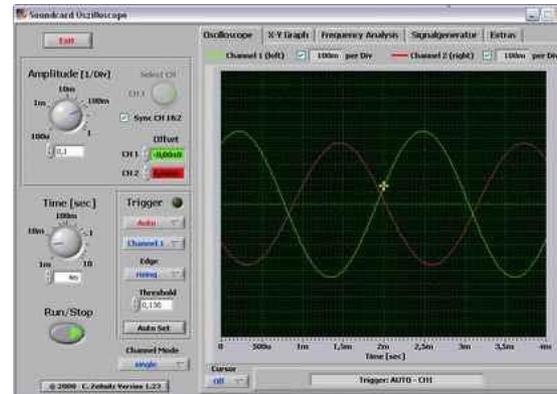
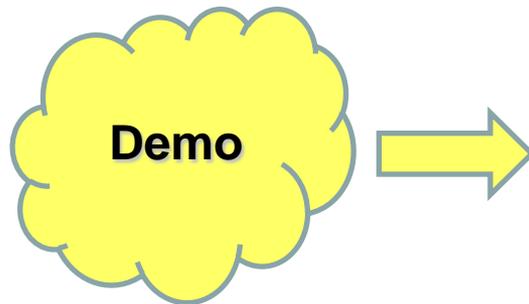
Retificador de onda completa com tap central

Determinando a tensão média de saída:



$$V_{med} = 0,636 \cdot V_m$$

Retificador de onda completa com tap central

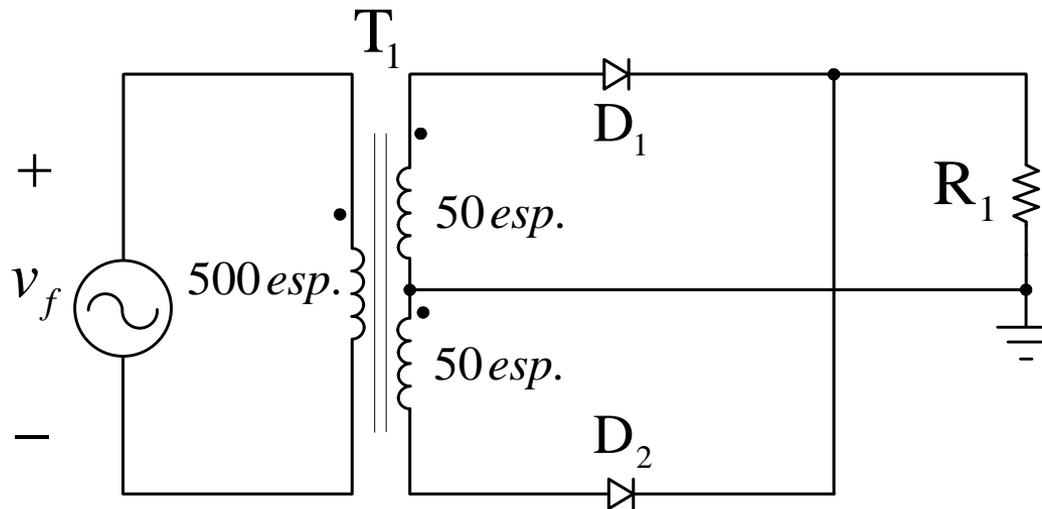


Demo:

- Retificador de onda completa;
- Tensão média na saída;
- Tensão reversa no diodo.

Retificador de onda completa com tap central

Considerando o circuito abaixo:



Considerando os dados ao lado, determine:

- Tensão eficaz no primário de T_1 ;
- Tensão eficaz no secundário de T_1 ;
- Tensão média na saída;
- Tensão de pico na saída;
- Tensão reversa sobre os diodos;
- Corrente média na saída.

$$v_f(t) = 311 \cdot \text{sen}(377 \cdot t) \text{ V};$$

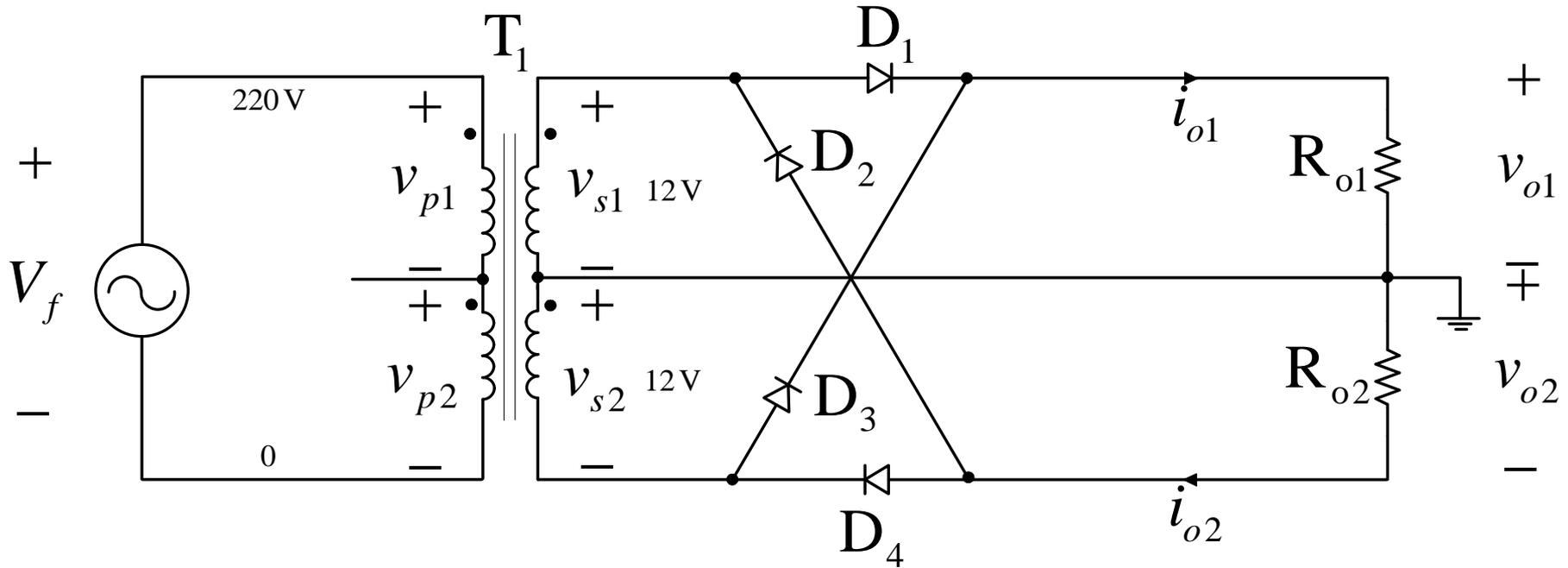
$$R_1 = 5 \Omega;$$

$$D_{1-2} = \textit{ideais};$$

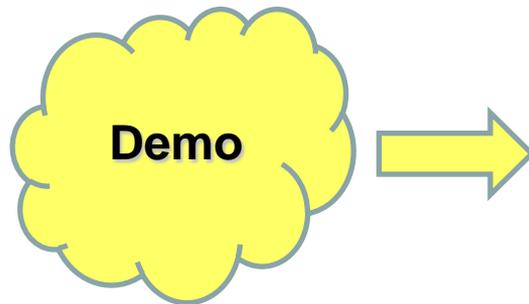
$$T_1 = \begin{cases} 10:1 \\ 10:1 \end{cases}$$

Retificador de onda completa simétrico

Princípio de funcionamento:

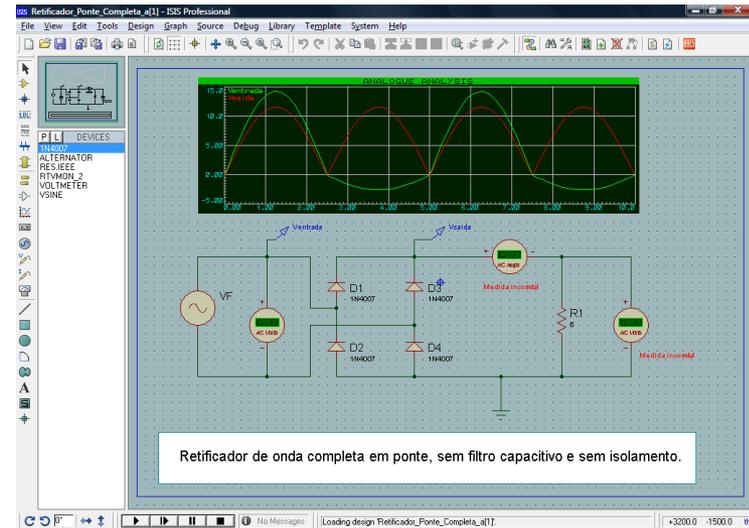


Retificador de onda completa simétrico



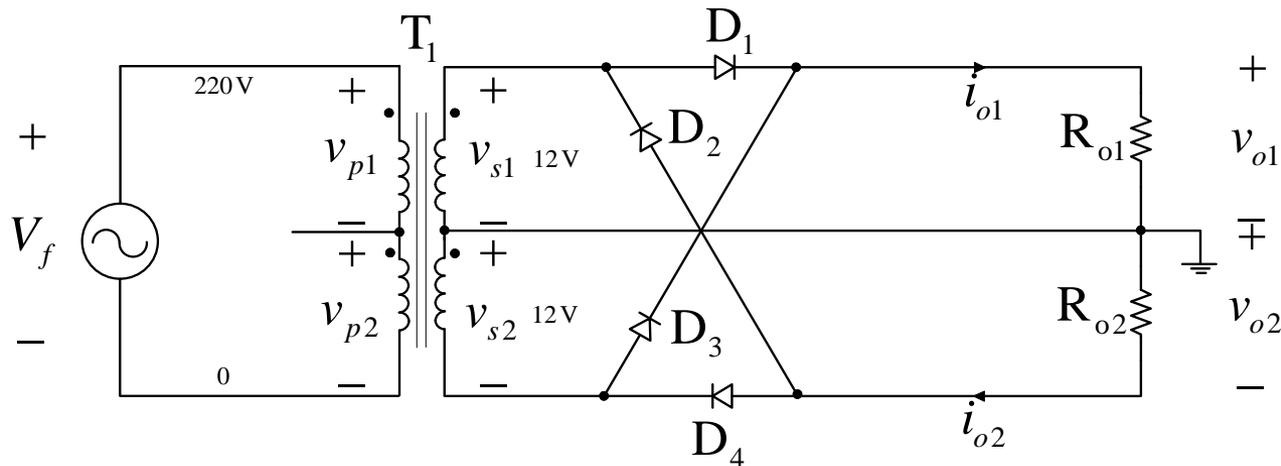
Demo:

- Princípio de funcionamento.



Retificador de onda completa simétrico

Considerando o circuito abaixo:



- Considerando os dados ao lado, determine:
- Descreva as etapas de funcionamento;
 - Tensão eficaz no primário de T_1 ;
 - Tensão de pico nos secundários de T_1 ;
 - Tensão média nas saídas;
 - Tensão de pico nas saídas;
 - Tensão reversa sobre os diodos;
 - Corrente média nas saídas.

$$v_f(t) = 311 \cdot \text{sen}(377 \cdot t) \text{ V};$$

$$R_{o1} = R_{o2} = 5 \Omega;$$

$$D_{1-4} = \textit{ideais};$$

$$T_1 = 110 + 110/12 + 12 \text{ V}$$

Próxima aula

Seqüência de conteúdos:

1. Simulação de circuitos retificadores.

