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Abstract

In order to understand the concept and purpose of rectifying a signal we'll be on a first hand studying the role of diodes to rectify a signal. Next we'll study the case of a bridge rectifier giving us an intuition for AC to DC conversions.

Preparation

Theoretical expressions for the root mean squared and the time-averaged potential difference are defined as :

$$\langle V \rangle = \frac{1}{T} \int_0^T V dt \quad V_{rms} = \sqrt{\langle V^2 \rangle} = \left(\frac{1}{T} \int_0^T V^2 dt \right)^{1/2}$$

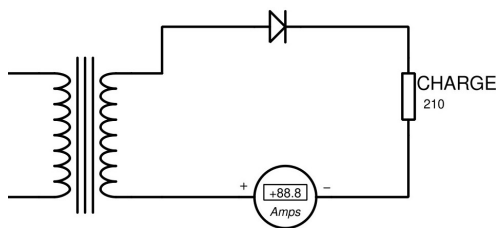
We can also find the ripple voltage as being : $V_{ripple} = \sqrt{V_{rms}^2 - \langle V \rangle^2}$

In addition to this we can find the ripple coefficient since :

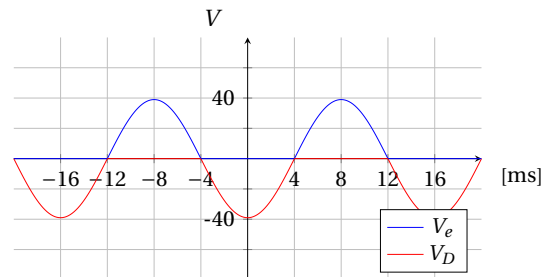
$$V_{ripple}^2 = V_{rms}^2 - \langle V \rangle^2 \Rightarrow \tau^2 = F^2 - 1 \Rightarrow \tau = \sqrt{F^2 - 1}$$

Simple Rectification

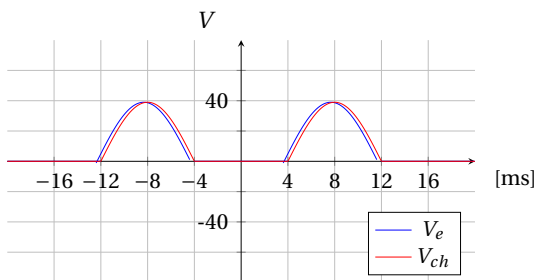
Resistive charge



Simple Single Phased Circuit



Chronographs V_e and V_D



Chronographs V_e and V_{ch}

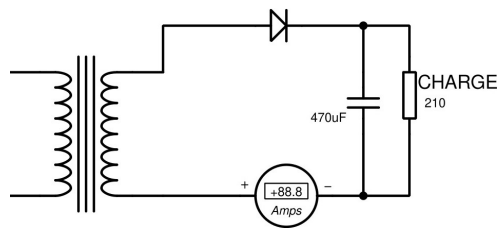
$\langle V_{ch} \rangle$	12.4 V
V_{ripple}	15.3 V
V_{rms}	19.4 V
$\sqrt{V_{rms}^2 - \langle V \rangle^2}$	14.9 V
τ	1.203

Measured Properties

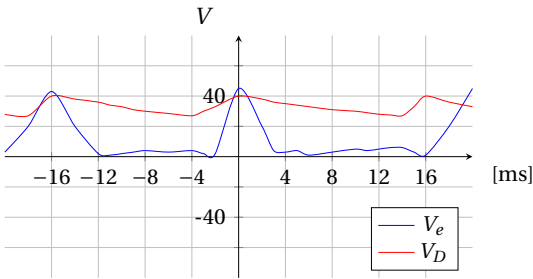
To extract these results we've used the oscilloscope in different coupling modes:

- AC coupling : used to determine the ripple voltage
- DC coupling : used to determine the time average voltage
- AC+DC coupling : used to determine the root mean square of the voltage

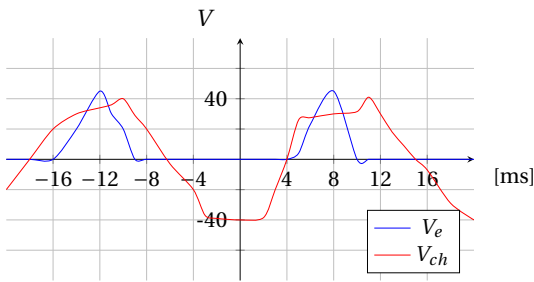
Capacitive Charge



Simple Single Phased Circuit



Chronographs V_e and V_D



Chronographs V_e and V_{ch}

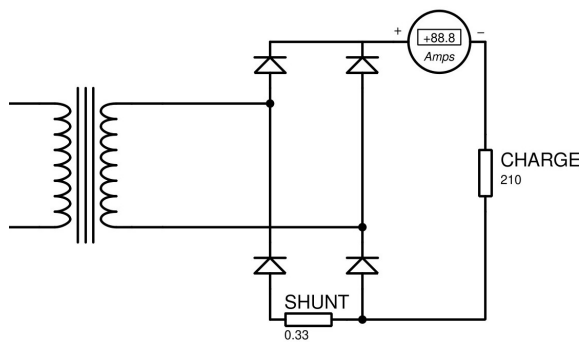
$\langle V_{ch} \rangle$	33.8 V
V_{ripple}	4 V
V_{rms}	34.1 V
$\sqrt{V_{rms}^2 - \langle V \rangle^2}$	4.5 V
τ	0.133

Measured Properties

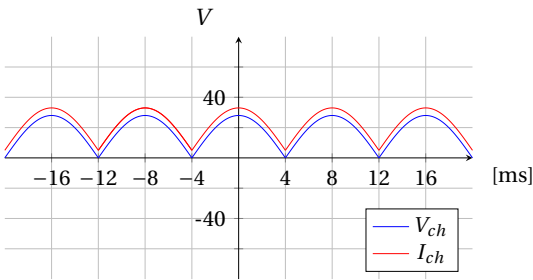
Using the same method as before we can extract the preceding results.

However an aspect to notice about this configuration is that the curve for our potentials aren't smooth. This can be explained by the fact the the transformer can not keep up with the power that is demanded by the capacitor, therefore it sort of lags a little before outputting the required potential to the charge.

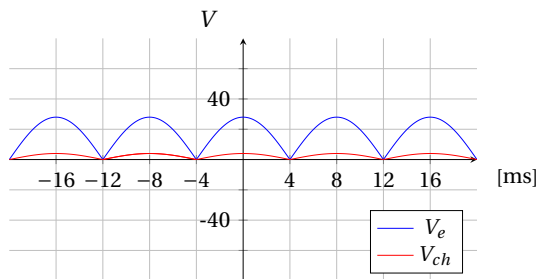
Graetz Bridge Rectifier



Single Phased Graetz Rectifying



Chronographs V_{ch} and I_{ch}



Chronographs V_e and V_{ch}

$\langle V_{ch} \rangle$	24 V	$\langle I_{ch} \rangle$	239 A
V_{ripple}	12.7 V	I_{ripple}	127 A
V_{rms}	27.1 V	I_{rms}	271 A
$\sqrt{V_{rms}^2 - \langle V \rangle^2}$	12.6 V	$\sqrt{I_{rms}^2 - \langle I \rangle^2}$	128 A
τ_V	0.529	τ_I	0.531

Measured Properties

When the input signal delivers a positive potential to the circuit, both diodes 1 and 4 are conducting this way the current can travel from the point of higher potential to the lowest without interruption.

On the flip side, if the signal starts delivering a negative potential then the previously mentioned diodes are then blocked, however diodes 2 and 3 become conducting, this way the charge is delivered the same potential difference, and any negative component is corrected to have a positive voltage on the charge.