Comparative Study of A.C. Circuits: - A Review

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Abstract— As we know, there are three basic AC Circuits namely purely resistive A.C. circuits, purely inductive & purely capacitive A.C. circuits having different properties along with their voltage equations current equations, circuit diagram, waveform & phase diagram. Here in this paper three mentioned circuits with their appropriate description have been explained. This Paper will be useful for those who need to know about these basic A.C. circuits.

Key words: A.C.

I. INTRODUCTION

The circuits which contains A.C. source is termed as A.C. circuit. This A.C. circuits has three basic circuits depend upon basic elements of electronics, ie R, L & C (Resistor, Inductor & Capacitor). Hence the three circuits referred as:

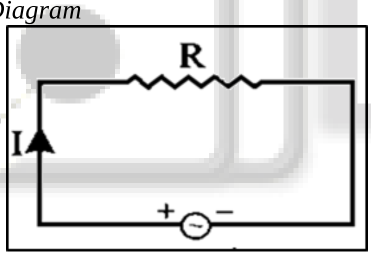
1) Purely Resistive A.C. circuits
2) Purely Purely inductive A.C. circuits
3) Purely Capacitive A.C. circuits

In this section we will discuss each circuit in detail.

A. *Purely Resistive A.C. Circuits*

As name indicates this circuit contains an A.C. source connected to resistor only.

1) *Circuit Diagram*



$V = V_m SinWt$

Fig. 1.1:

Fig. 1.1 shows Purely Resistive A.C. Circuits. In which only a resistor is Connected along with A.C. Voltage source V= V_m Sin Wt in series.

2) *Statement:*

In Purely Resistive A.C. Circuits resistor is connected across A.C. source. If we do so the voltage & current flows through the circuit. In this circuit, there is no phase difference between voltage & current. The voltage & Current are in phase. It can also be state that the phase angle Ø between V & I is <u>zero</u> for this circuit.

3) *Equations of Voltage & Current:*

1) Eq^n. for voltage

$V = V_m$ Sin Wt

2) Eq^n. for current

As there is no phase difference between V & I

So equation for I is:

$I = I_m$ Sin Wt

d) Waveforms:

$V = V_m$ Sin Wt

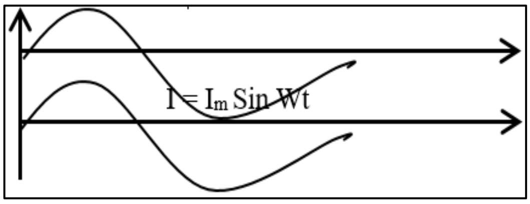


Fig. 1.2:

4) *Phasor Diagram*

As I and V are in phase, both will be in same direction.

V, I

Fig 1.3

B. *Purely Inductive A. C. Circuits*

As name indicates This Circuit contains an A.C. source along with an inductor only.

1) *Circuit Diagram*

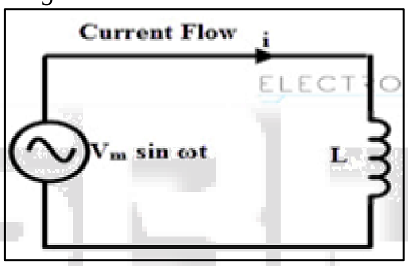


Fig. 2.1:

Fig. 2.1 shows purely Inductive A.C. Circuit, in which only Inductor is connected across an A. C. Voltage source V = VmSinwt. in series.

2) *Statement*

In Puerly Inductive A.C. Circuit, an Inductor is connected across an A.C. Voltage source. If it is connected, V & I flows through Circuit. Then there is a phase difference between V & I. In this Current I is lagging to the applied Voltage V= VmSinWt by an angle of exactly 900.

3) *Equations of V & I*

1) Eqn. for V :- as it is basic applied source :- V=VmSinWt.
2) Eqn. for I: as it is lagging to V by 900. It means I is flowing delayed after V by 900

I = Im Sin (Wt-90)

(- Sign because of lagging)

4) *Waveforms*

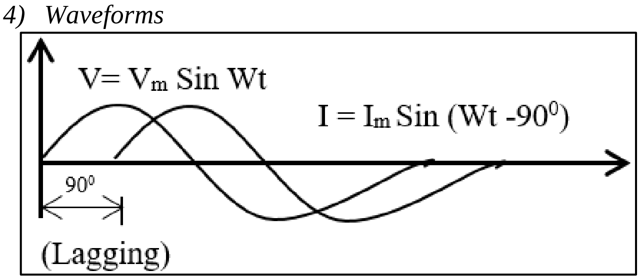


Fig. 2.2:

5) Phasor Diagram

Because of lagging, I will be in downward direction.

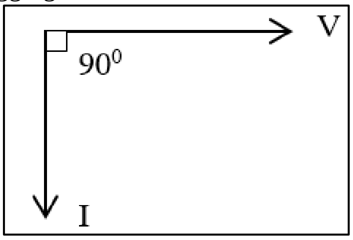


Fig. 2.3:

C. Purely Capacitive A. C. Circuits

As name indicates this Circuit contains An A.C. Voltage source connected across a Capacitor only.

1) Circuit Diagram

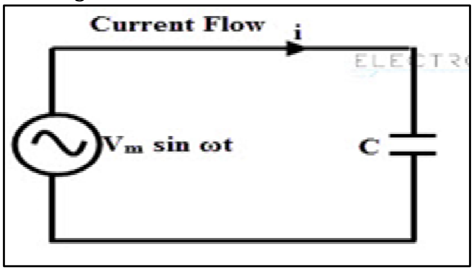


Fig. 3.1:

Fig. 3.1 shows purely Capacitive A.C. Circuit, which contains a AC voltage V = Vm SinWt connected in series with a capacitor.

2) Statement

In purely Capacitive AC Circuit a Capacitor is connected in series across V= VmSin Wt. If we do so, there is a Phase difference between V & I. In this Current I is always leading to applied Voltage V= Vm sinWt. By an angle of exactly 90^0.

3) Equations of Volatage & Current

1) Eq^n. for voltage
   V= VmSinWt.
2) Eq^n. for I: as it is leading to V by 90^0. It means I starts flowing earlier than V by 90^0.
   I = Im Sin(Wt+90) (+ Sign because of leading)

4) Waveforms

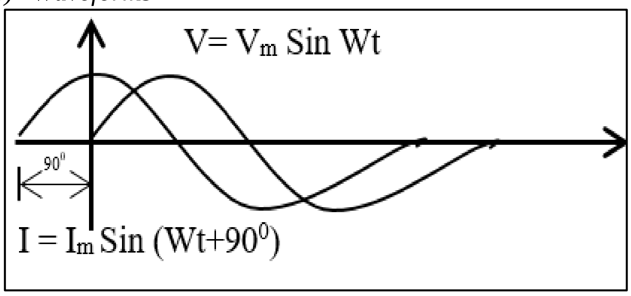
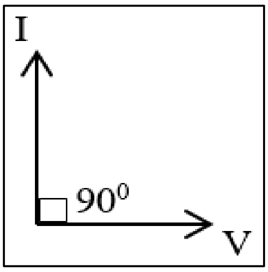


Fig. 3.2:

5) Phasor Diagram

As I is leading to V, I will be in upward direction.



II. Power Factor Status

As we know Power Factor is termed as Cos Ø that means it is cosine angle of Ø.
(Ø: angle between V & I)
Hence we can relate P.F. For these three circuits.

	Purely R	Purely L	Purely C
Ø	Neither leading nor lagging	Lagging	Leading
Value of Ø	0	-90^0	90^0
Cos Ø(P.F)	1	0	0

Table 1: Shows Power Factor Status

III. Summarization

From above discussion it can be summarized that Power Factor for Purely Resistive AC Circuit is neither Leading nor lagging. Power Factor is Unity for Resistive circuit. For Inductive AC Circuit PF is lagging & for Purely Capacitive AC circuit nature of PF is leading.

IV. Conclusion

This paper explains the basic circuit's purely resistive A.C. circuits, purely inductive & purely capacitive in detail. It includes circuit diagram, statement, equations for V & I, waveforms & phase diagrams of the circuits mentioned above. With the reference of these explanation, nature of power factor for above circuits is also discussed. At the end, it can conclude that, this paper may set as a guideline for the persons who needs to learn the basics of these A.C. circuits.

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