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# Matlab Simulation for Power Factor Correction

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***Abstract: Lower in Power Factor of electrical equipments will draws high current from supply power. The effect of this is affected by impedance of electrical equipment. Therefore, the main consideration of this study is how impedance of electrical equipment affects the power factor of electrical loads, and then distributed power as the whole. This study is important to verify the right action to increase low power factor effectively for electrical energy efficiency concern.***

## I. INTRODUCTION

Power factor (PF) is the ratio of Real power, measured in kilowatts (kW), to apparent power, measured in kilovolt amperes (kVA) or also known as demand. It will get by multiplying [kVA=V*A]. The result will be in kVA units.

### *A. Power factor basics*

Power quality will efficient for equipment operation, it is one of the advantage of power factor. Power factor will gives the detail about how efficiently input power is used in an electrical installation. It is the ratio of Real power to apparent power,

When,
Active Power (P) = the power required for useful work, SI unit is Watt or KiloWatt (kW).
Reactive Power (Q) = It is the stored energy effected to the source, SI unit is var or Kilovar (kVAR)
Apparent Power (S) = the vector sum of active and reactive power, SI unit is Volt Amperes or in KiloVolt Amperes (kVA)

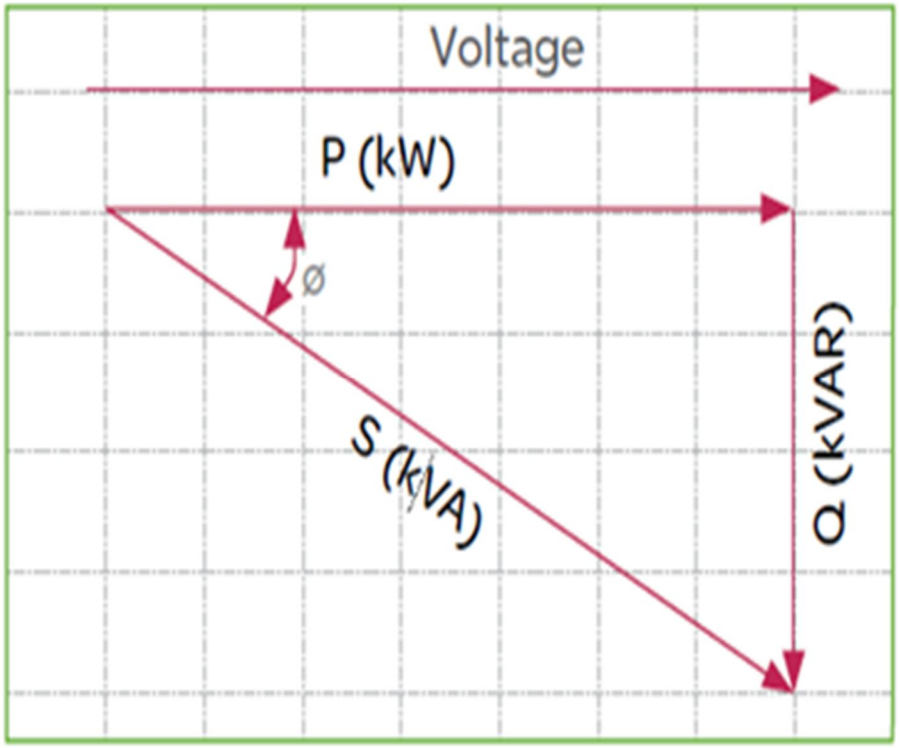


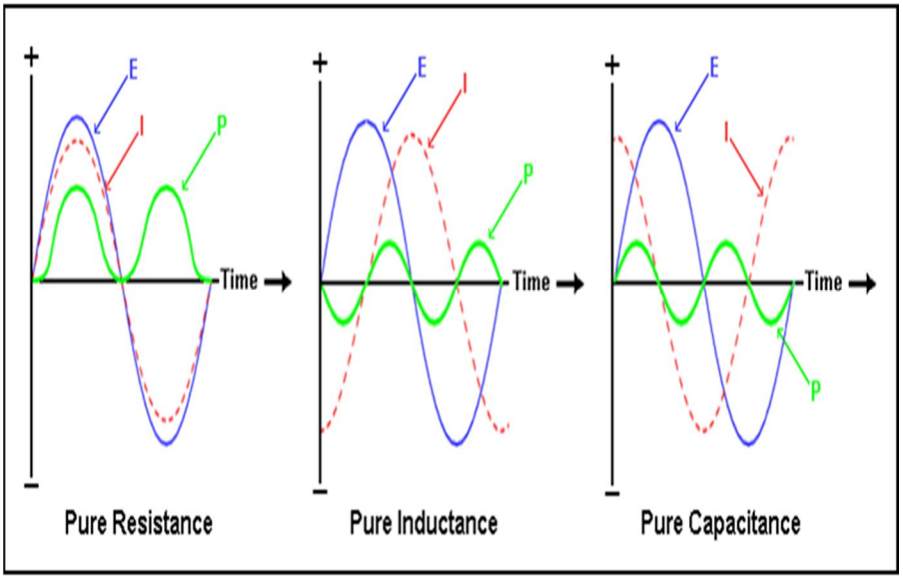

Fig.1.The power triangle

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*B. Correction of Power Factor*

The main aim of Power factor correction (PFC) is to improve power factor, and also reduces the load acts on the distribution system, increases energy efficiency and reduces costs of electricity . It also decreases the instability and failure of system components.

Power factor correction is nothing but connecting the capacitors which produce reactive. Electrical Energy in opposition to the Electrical Energy absorbed by loads like motors, nearly close to the load. It improves the power factor where the reactive power source is connected.




*1) Example Problem For Power Factor Correction*

(Question)A three phase static load takes real power of 10kWand reactive power of 5kVAR from a three phase two winding transformer (11/0.415kV,25MVA). The HV side of transformer connected to 11kV ,50Hz three phase supply .[1].Calculated power factor of the load ? [2].Calculate the capacitor bank (capacitive VAR) required to maintain the power factor of 0.95 at load side ?

*2) Solution*

$$\text{Power Factor} = \frac{\text{Real Power (P)}}{\text{Apparent power (S)}} = \frac{P}{\sqrt{P^2+Q^2}}$$

$$\text{Power Factor} = \frac{10}{\sqrt{10^2+5^2}} = 0.8944$$

*3) Capacitor bank required to maintain 0.95p.f*

Q rating of capacitor bank at load sisde =
P tan(actual pf angle–required pf angle)
=10*tan(Acos(0.8944) – cos(0.95))
=10*tan(26.5685 – 18.1949)
Q rating of capacitor bank at load side =1.472 kVAR.
Q rating of capacitor bank at load side =1.472 kVAR.

*C. System Parameters*

*1)* Three phase source :11kV,50Hz
*2)* Transformer :11kV /0.415kV ,25MVA
*3)* Load details 10KW ,5 kVAR
*4)* Line length:10m

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## II. MATLAB SIMULATION MODEL

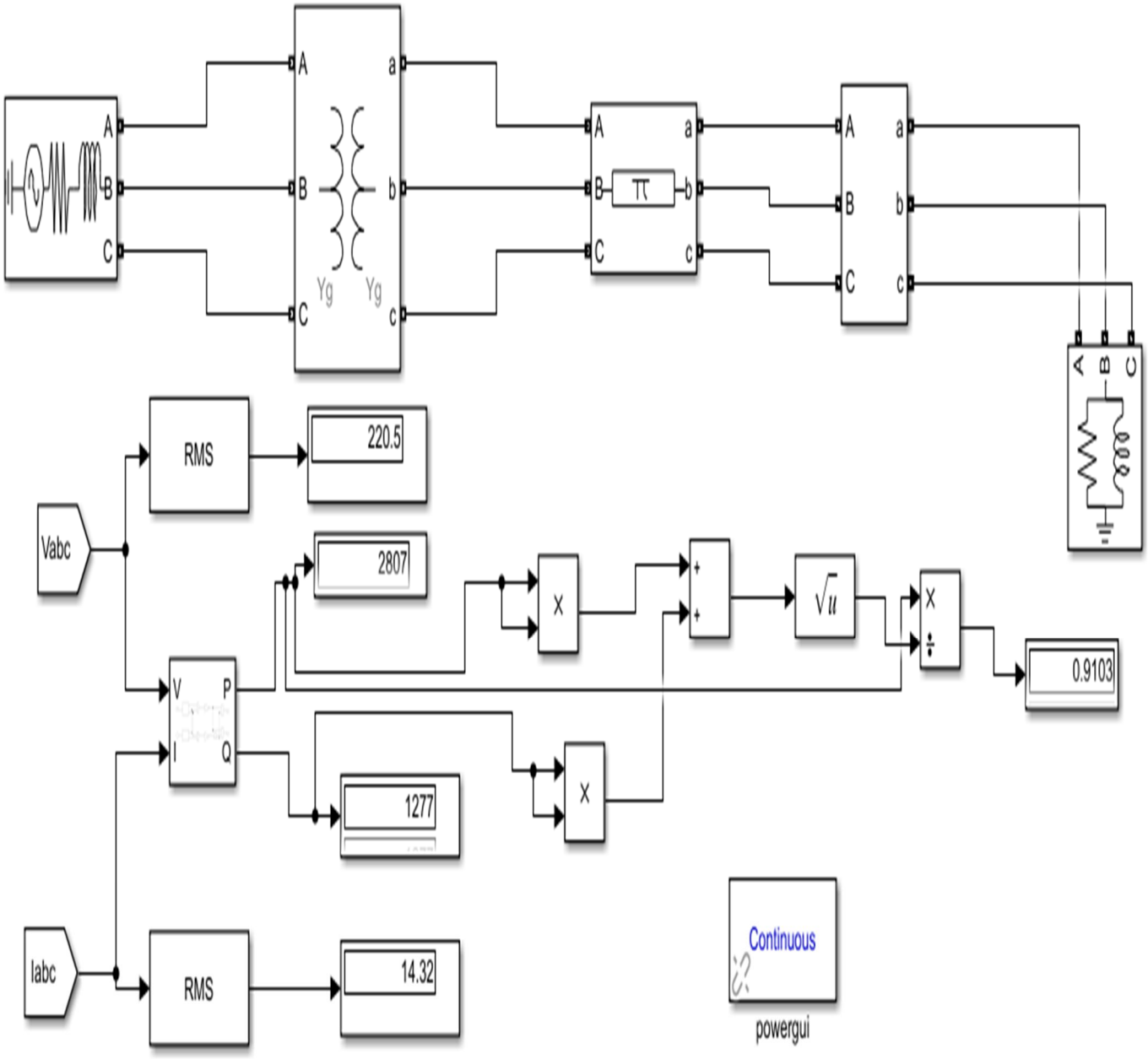



Fig.2.Simulation model without capacitor bank

The above figure shows the practical MATLAB simulation of the model. It contains generation system and output of the generator is connected to the 11kV/415v, 25MVA and the secondary of the transformer is transmitted through the transmission line and the output supply is connected the R-L load of 10kw,5 kvar which drawing the power factor the 0.8944 to improve the power factor of the system the calculation the capacitor bank should be required. In the above system there is no capacitor bank in between load and transmission line

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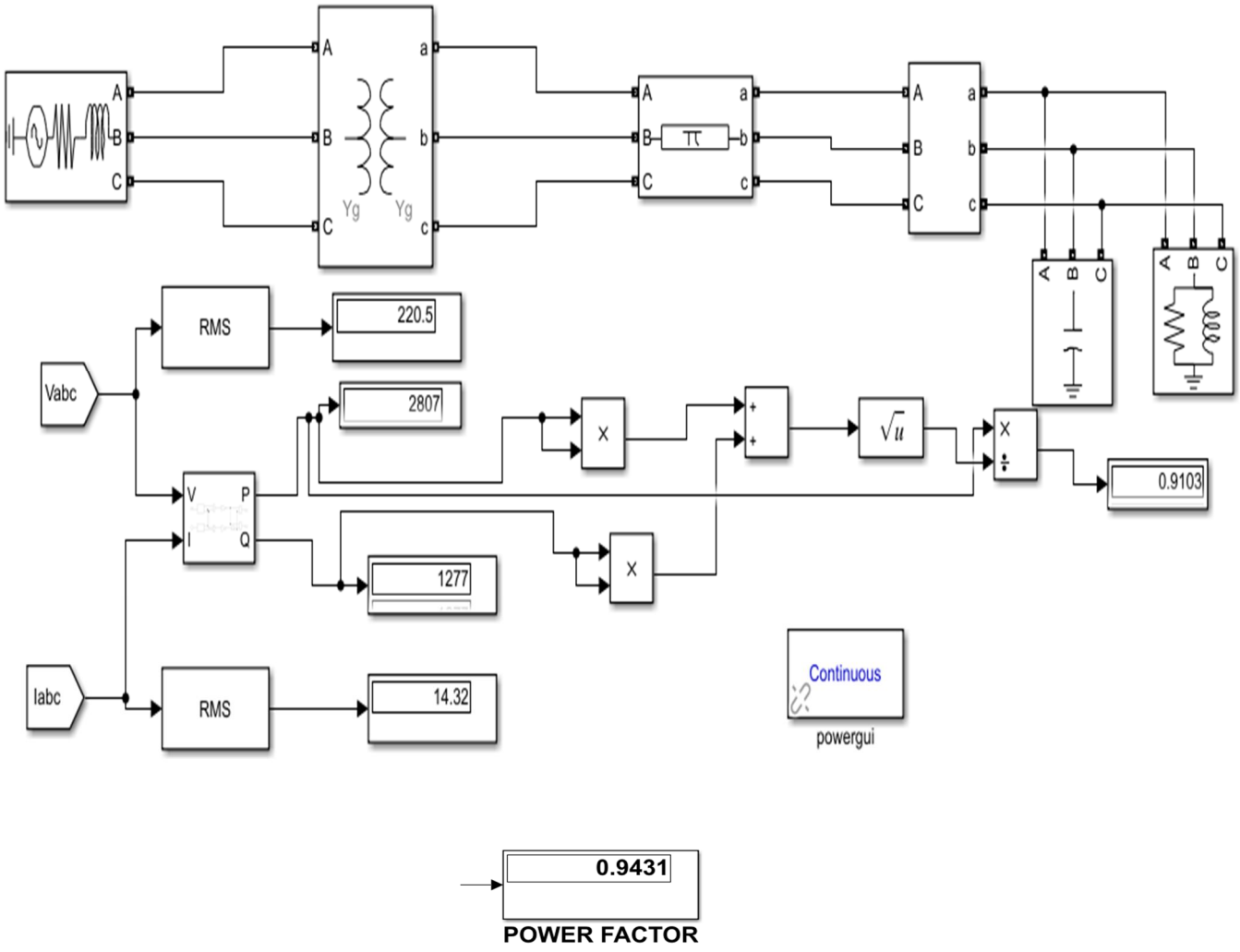



Fig.3.Simulation model with capacitor bank

After calculating the capacitor value it will be inserted in between the line and load the power factor of the system will improved to 0.9pf . The below figures of wave forms will gives the values of terminal voltage and current.

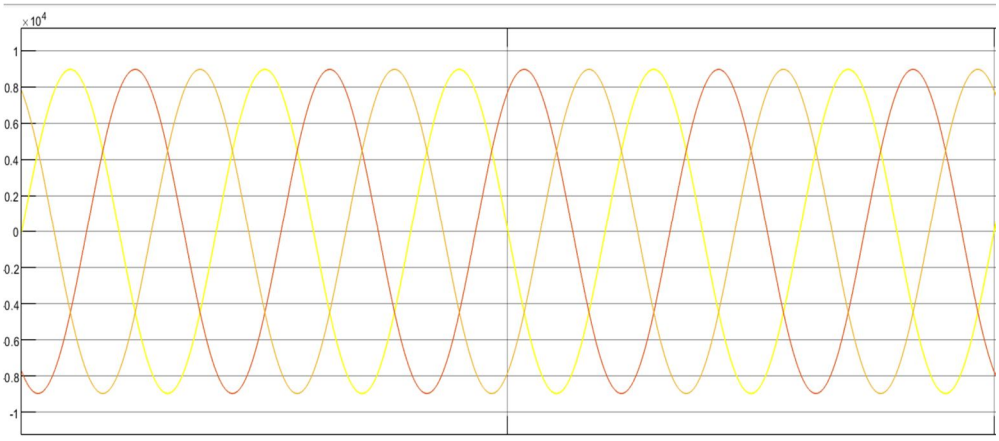



Fig.4.Generation voltage

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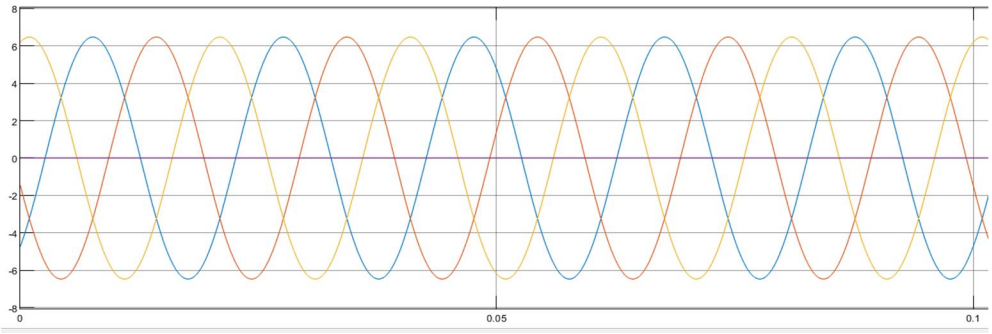



Fig.4.Input current

## III. CONCLUSION

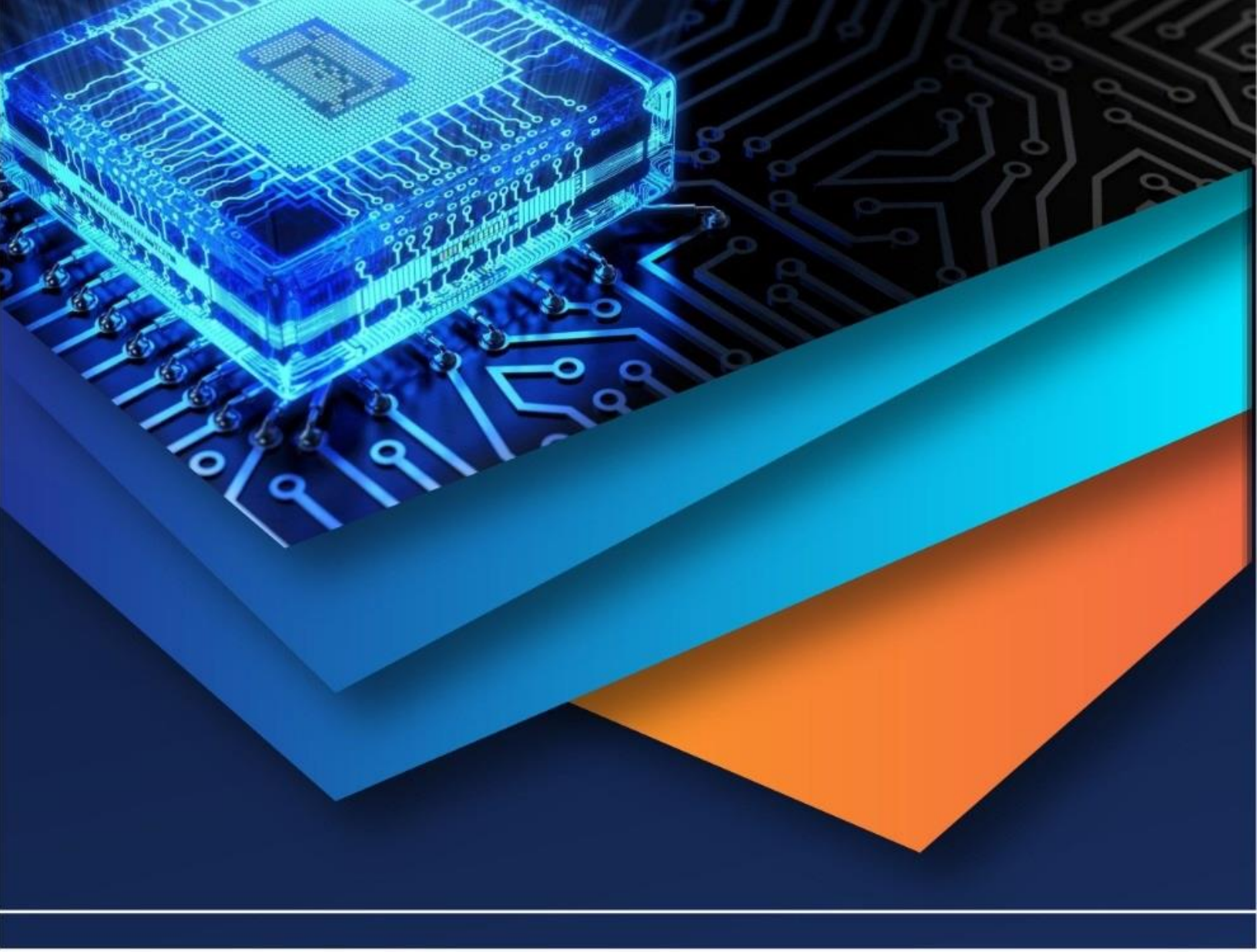
In this paper author will discussed about the basic introduction about the power factor and also short description about the power factor correction. For the power factor correction author will taking the real time problem as a problem statement and also calculated the theoretical calculation as well as simulated the practical model in the mat lab simulation and the values of capacitor bank(kVar) will be verified and observed the with capacitor and without capacitor condition of the power factor.

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