



SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)



COIMBATORE-35

**Accredited by NBA-AICTE and Accredited by NAAC – UGC with A+ Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai**

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

**COURSE NAME: 19EET207/ SYNCHRONOUS AND INDUCTION
MACHINES**

II YEAR / IV SEMESTER

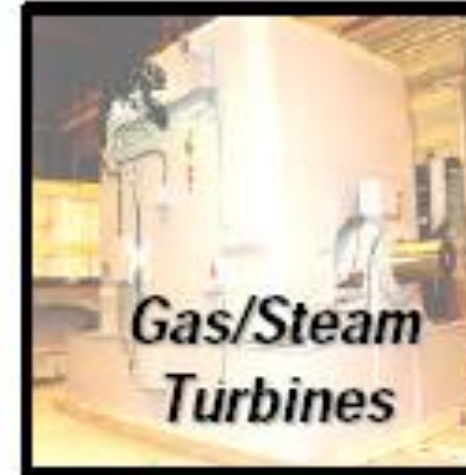
Unit 1 – SYNCHRONOUS GENERATOR

Topic 4,5,6: Synchronous reactance Armature reaction – Phasor diagrams





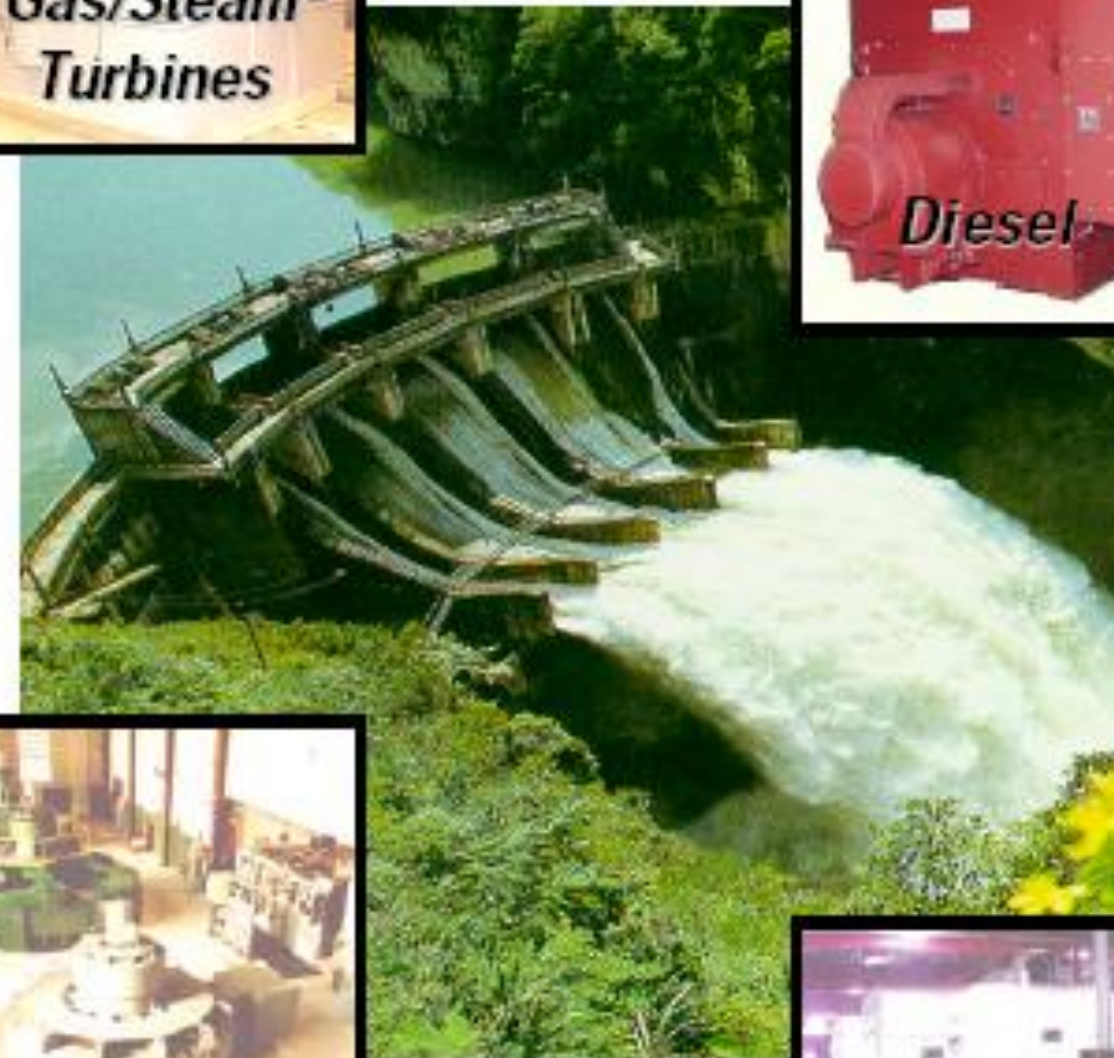
GUESS THE TOPIC NAME...



Gas/Steam
Turbines



Diesel



Hydro



Special
Applications

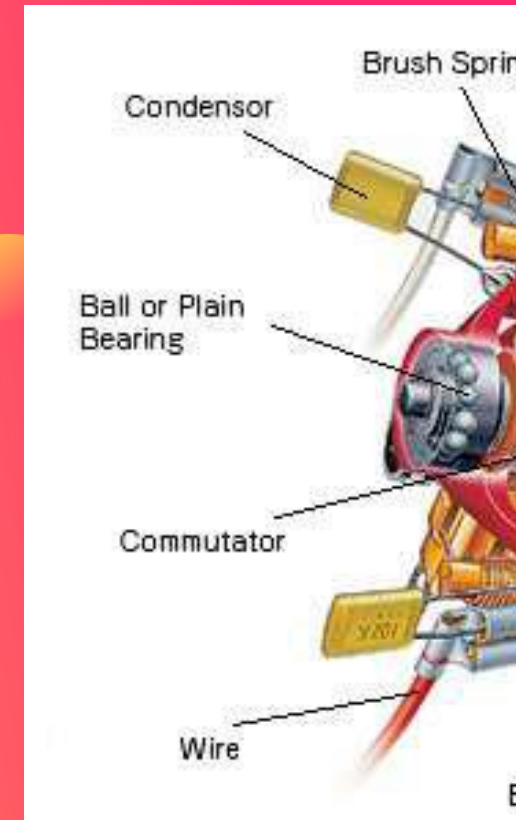


Causes of Voltage drop in Alternator

Armature Effective Resistance (R_{eff})

Armature Leakage Reactance (X_L)

Armature Reactance





Armature Leakage Reactance(X_L)



Armature Leakage Reactance(X_L)

Three major components - Slot leakage reactance, end winding leakage reactance and tooth tip leakage reactance.

Synchronous reactance / phase

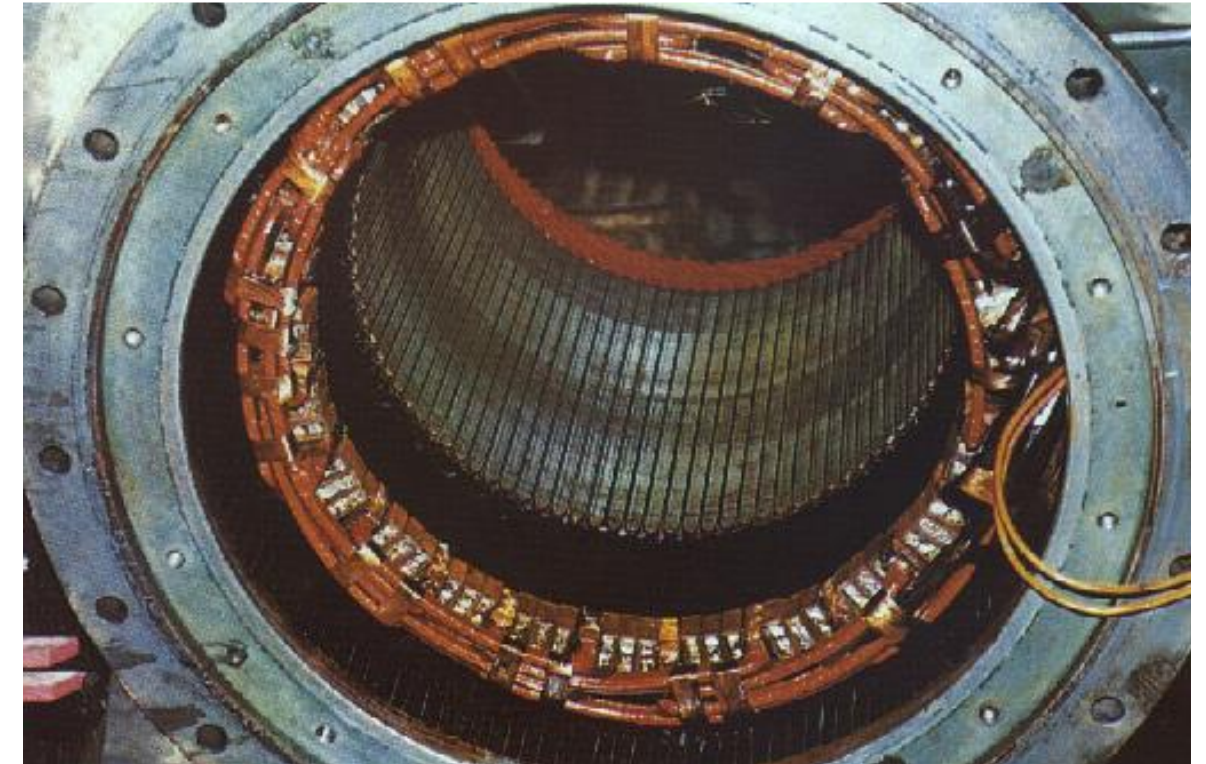
$$X_s = X_L + X_a$$

where

X_a is the fictitious armature reaction reactance.

Synchronous impedance/phase

$$Z_s = (R_a + jX_s)$$





Synchronous Reactance



- The value of X_S can be determined by measurements of the open-circuit and short-circuit tests
 - Test are conducted under an unsaturated core condition
 - Open-circuit test is conducted at rated speed with the exciting current I_{xn} adjusted until the generator terminals are at rated voltage, E_n
 - Short-circuit test is conducted at rated speed with the exciting current I_{xn} gradually raised from 0 amps up to the original value used in the open-circuit test
 - The resulting short-circuit current I_{sc} is measured, allowing the calculation of X_S
$$X_S = E_n / I_{sc}$$
Where:
 - X_S = Synchronous reactance per phase [Ω]
 - E_n = Rated open circuit voltage line to neutral [V]
 - I_{sc} = Short-circuit current, per phase, using same exciting current I_{xn} that was required to produce E_n [A]



Armature Reaction



Effect of the **armature flux** on the **main field flux**.

Armature Reaction effect depends upon the **PF of the Load**

UPF - cross magnetizing.

Lag PF - demagnetizing.

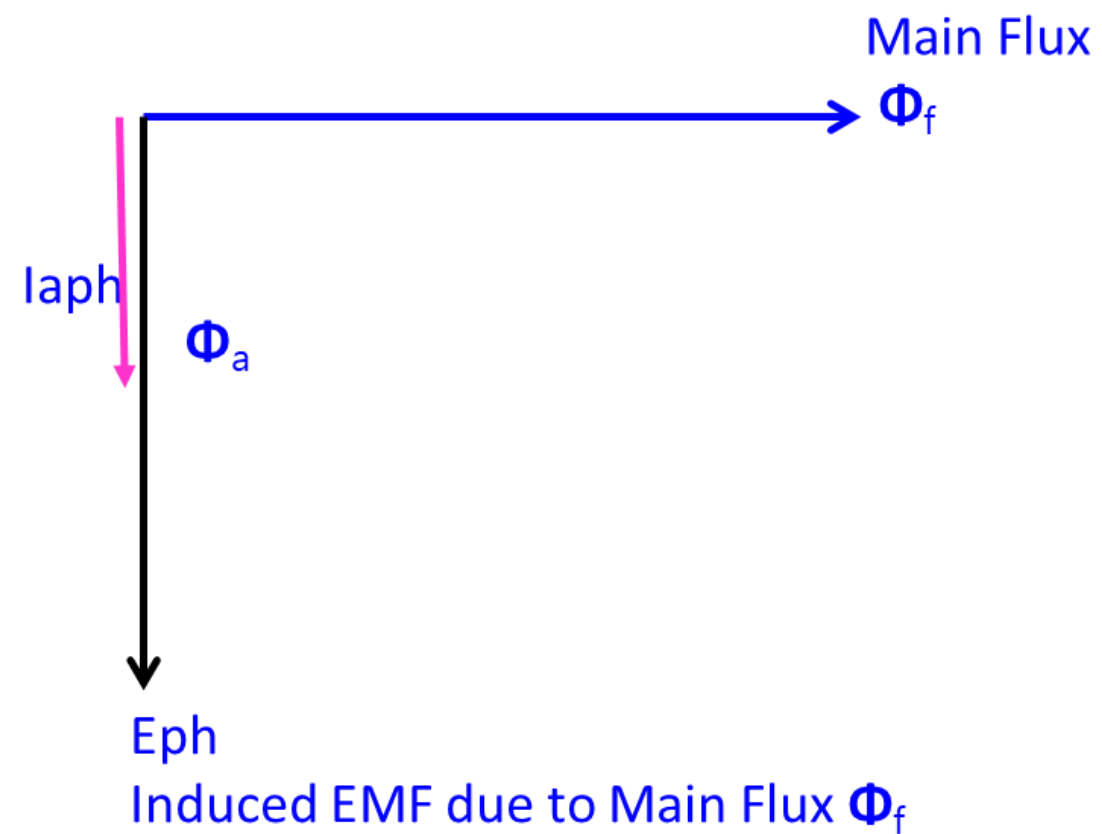
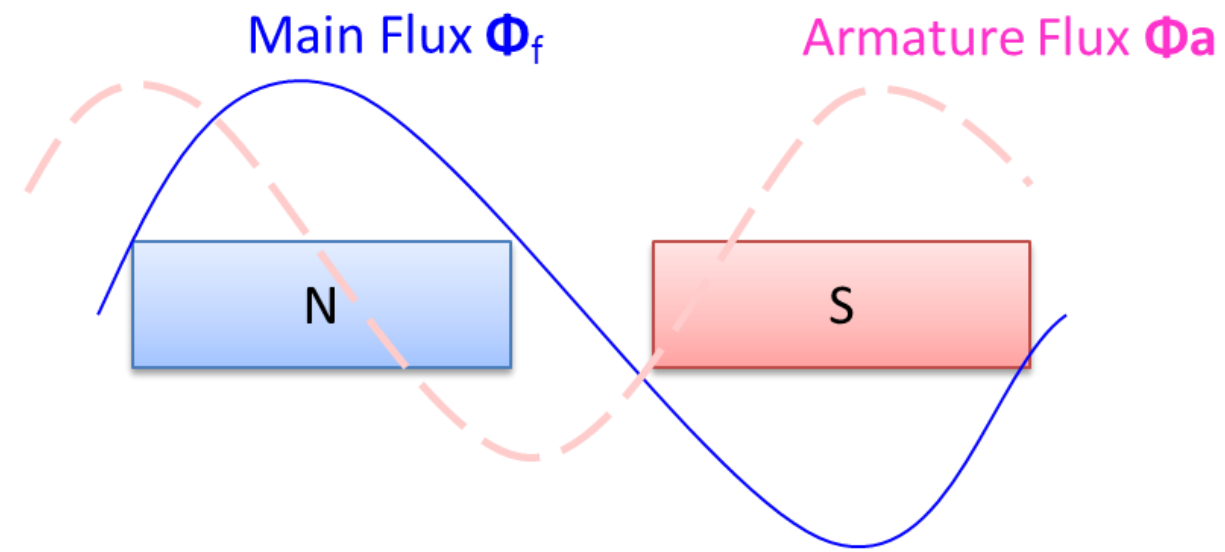
Lead PF - magnetizing



UPF (Pure Resistive Load)-cross magnetizing



UPF (Pure Resistive Load)
cross magnetizing

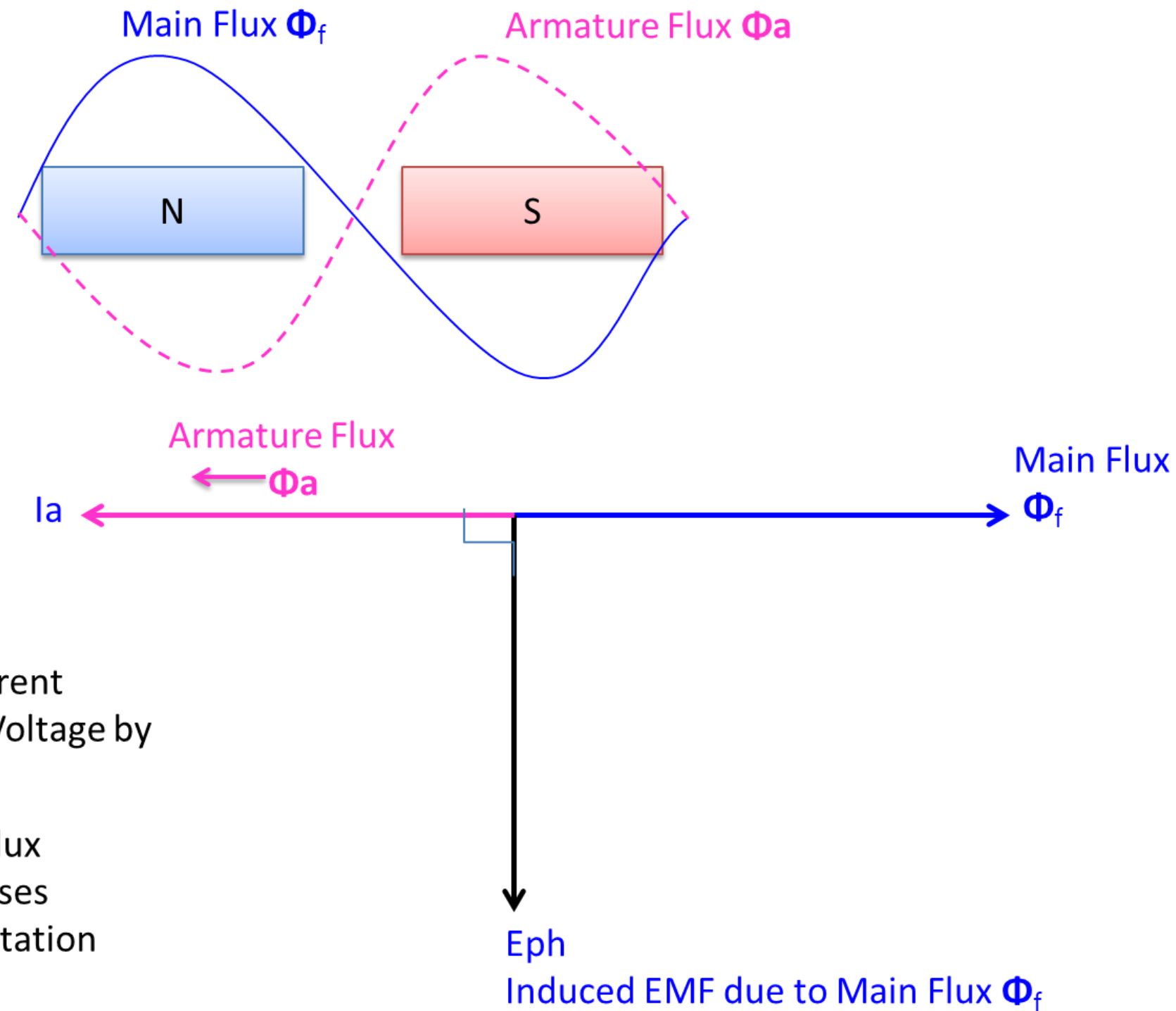




Lagging PF (Purely Inductive Load) Demagnetizing



Lagging PF (Purely Inductive Load)
Demagnetizing



Load current
Lag the Voltage by
90

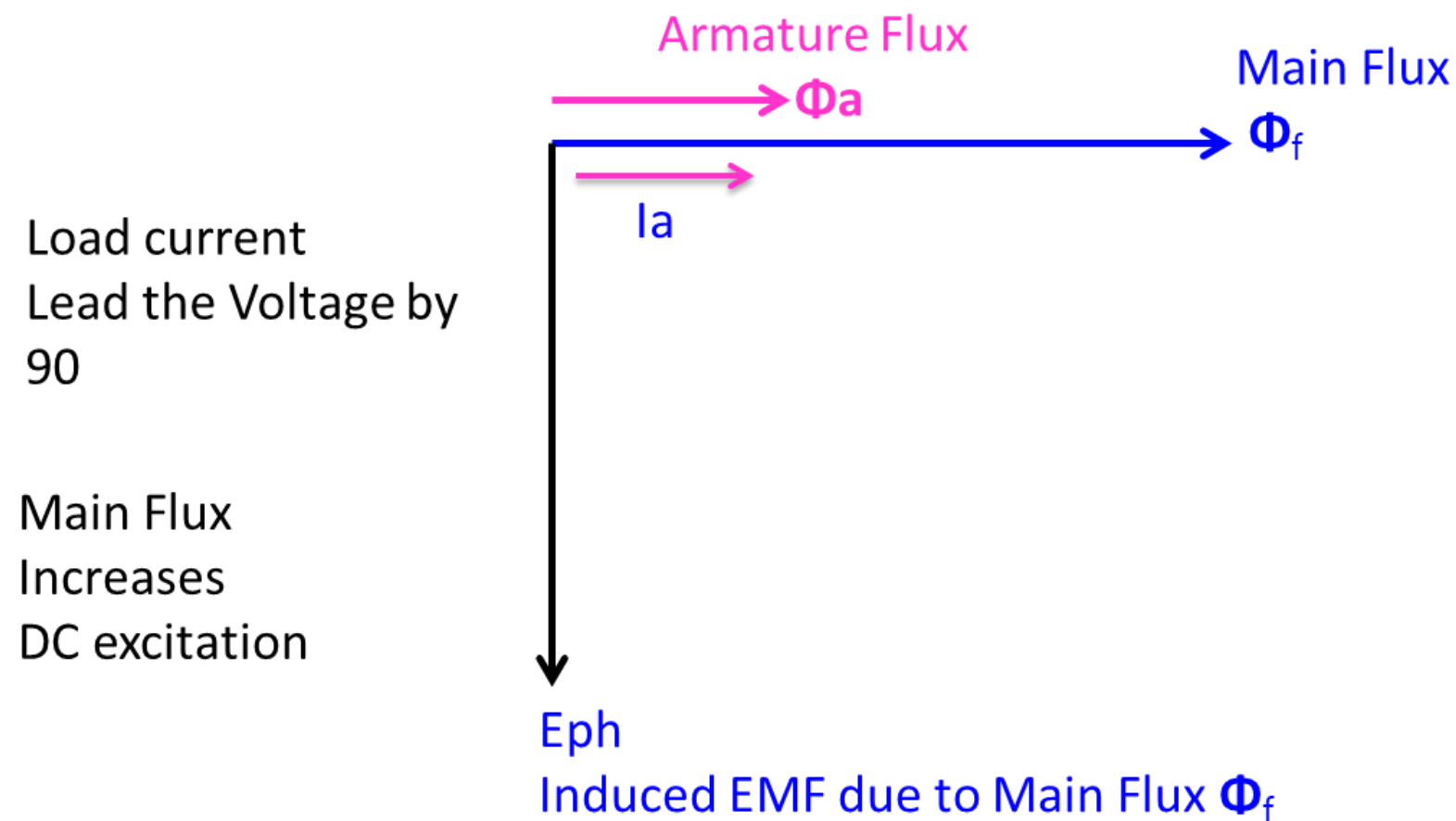
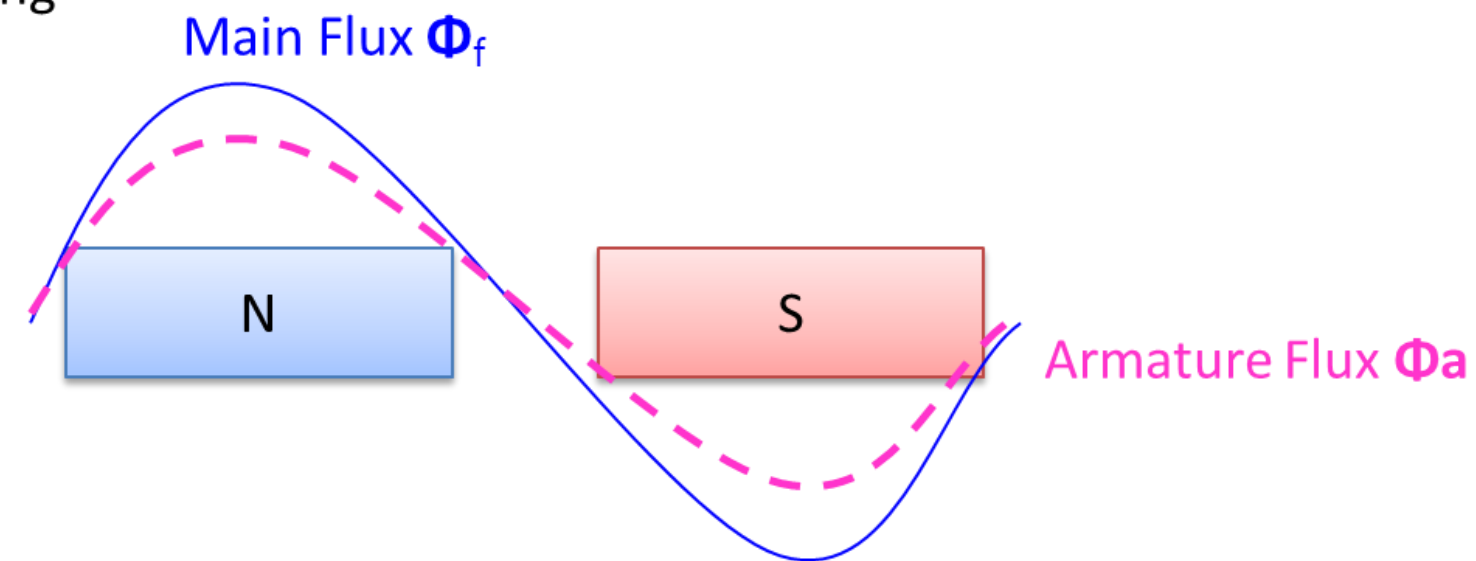
Main Flux
Decreases
DC excitation



Lead PF (Purely Capacitive Load) Magnetizing



Lead PF (Purely Capacitive Load)
Magnetizing





SUMMARY

Synchronous reactance Armature reaction –
Phasor diagrams



KEEP
LEARNING..
Thank u

SEE YOU IN NEXT CLASS