

# **SNS COLLEGE OF ENGINEERING**

Kurumbapalayam (Po), Coimbatore – 641 107

**An Autonomous Institution**

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 : 19EE605 PROTECTION AND SWITCHGEAR**

III YEAR /VI SEMESTER

Unit 5- CIRCUIT BREAKER

Topic: Current Chopping



# What is Current Chopping?

## 1 Rapid Interruption

Sudden and unintended interruption of current flow in a circuit

## 2 Voltage Spikes

Generation of high-magnitude transient overvoltages

## 3 Mechanical Switching

Occurs during mechanical operation of circuit breakers



# Causes of Current Chopping

## Capacitive Loads

Abrupt current interruption in capacitive circuits

## Inductive Loads

High  $di/dt$  at current zero-crossings

## Arcing Phenomena

Instability and irregular arc extinction



# Impacts of Current Chopping

## Transient Overvoltages

Can damage insulation and equipment

## Mechanical Stresses

Cause fatigue and weakening of components

## Power Quality Issues

Disruption of sensitive electronic loads

## System Reliability

Increased risk of outages and failures

# Mitigating Current Chopping

1

## Surge Arresters

Provide overvoltage protection for equipment

2

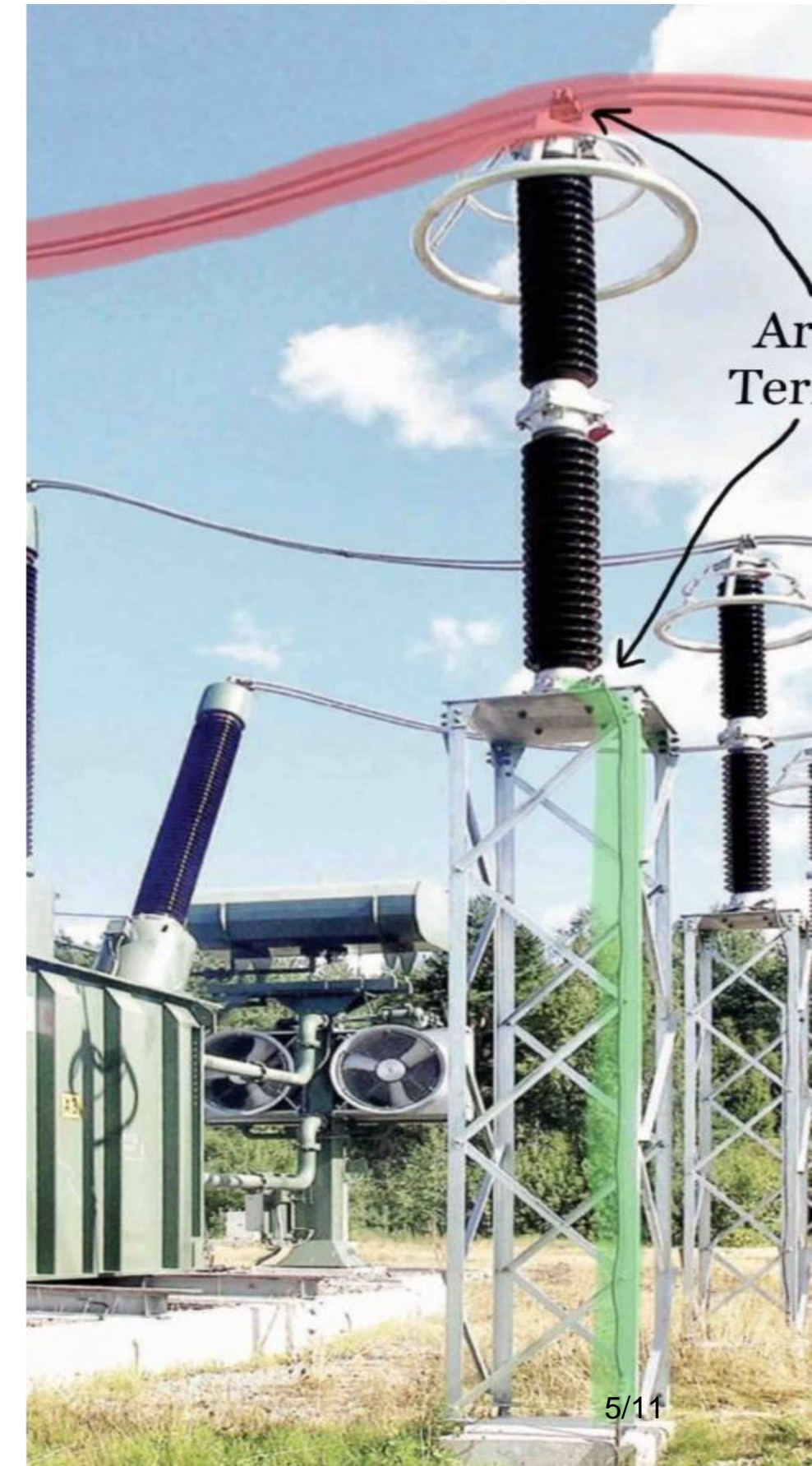
## Damping Circuits

Absorb and dissipate transient energy

3

## Controlled Switching

Synchronize breaker operation with load conditions





# Impact on Power System Design

## Equipment Ratings

Increased insulation and surge withstand requirements

## Transformer Design

Adequate winding protection against transients

## Circuit Breaker Selection

Choosing models with better current chopping performance



# Simulation and Analysis



## Transient Voltages

Evaluate magnitude and duration of spikes



## Current Profiles

Assess  $di/dt$  and chopping characteristics



## EMTP Modeling

Detailed simulation of system behavior

# Testing and Validation



1

## Laboratory Tests

Controlled evaluation of breakers and components

2

## Field Measurements

Monitoring real-world system performance

3

## Model Validation

Correlate simulation results with test data





# Future Trends

## Wide Bandgap Devices

Improved current interruption capabilities

## Adaptive Protection

Dynamic adjustment to changing conditions

## Renewable Integration

Mitigating current chopping in inverter-based systems



# Assessment



What phenomenon occurs when a circuit breaker interrupts a high-current circuit abruptly?

- a) Voltage surging
- b) Current chopping.
- c) Power loss
- d) Capacitive coupling





# References



1. Sunil S Rao, “Switchgear, Protection and Power System (Theory, Practice & Solved Problems)”, Khanna Publishers, New Delhi, 2019.
2. Paithankar Y G, Bhide S R, “Fundamentals of Power System Protection”, Prentice Hall of India Pvt Ltd., New Delhi, 2<sup>nd</sup> Edition, 2014.
3. Badriram, Vishwakarma B.H, “Power System Protection and Switchgear”, New Age International Pvt Ltd Publishers, 2<sup>nd</sup> Edition 2017.

**Thank You**