

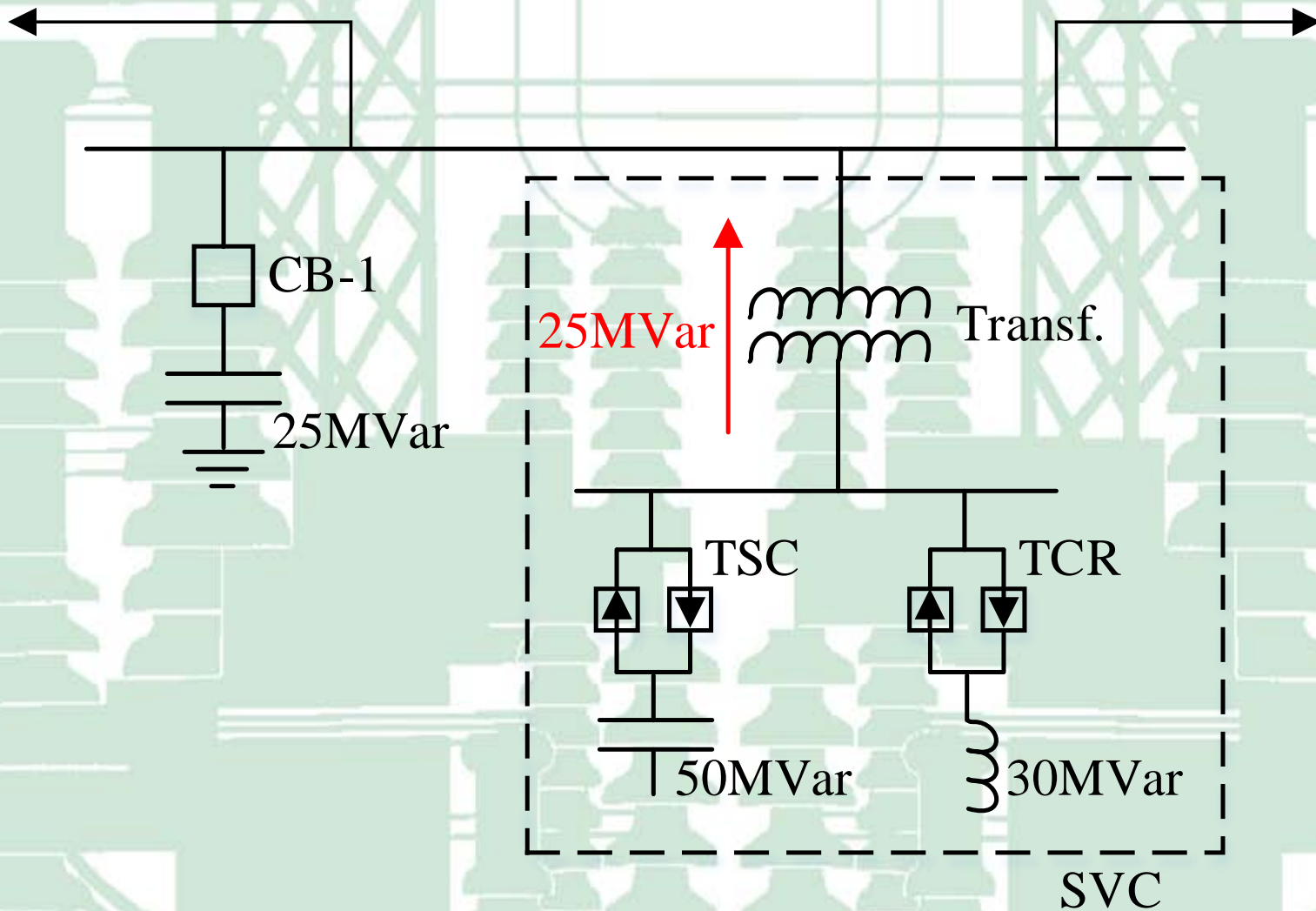


A Reactive Power Controller to Optimize Performance of Dynamic Reactive Power Compensation Devices

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Introduction



Goals:

- Regulate system voltage
- Optimize DRD reactive power output

Benefits:

- Automatic coordination of shunt devices
 - Less mal-operation risk
- Standard approach increases user acceptance

Limitations:

- Controls SSDs only
 - Indirect control over DRD

Simultaneous Control Strategies

Regulate System Voltage

Optimize DRD Reactive
Power Output

Voltage Control Strategy

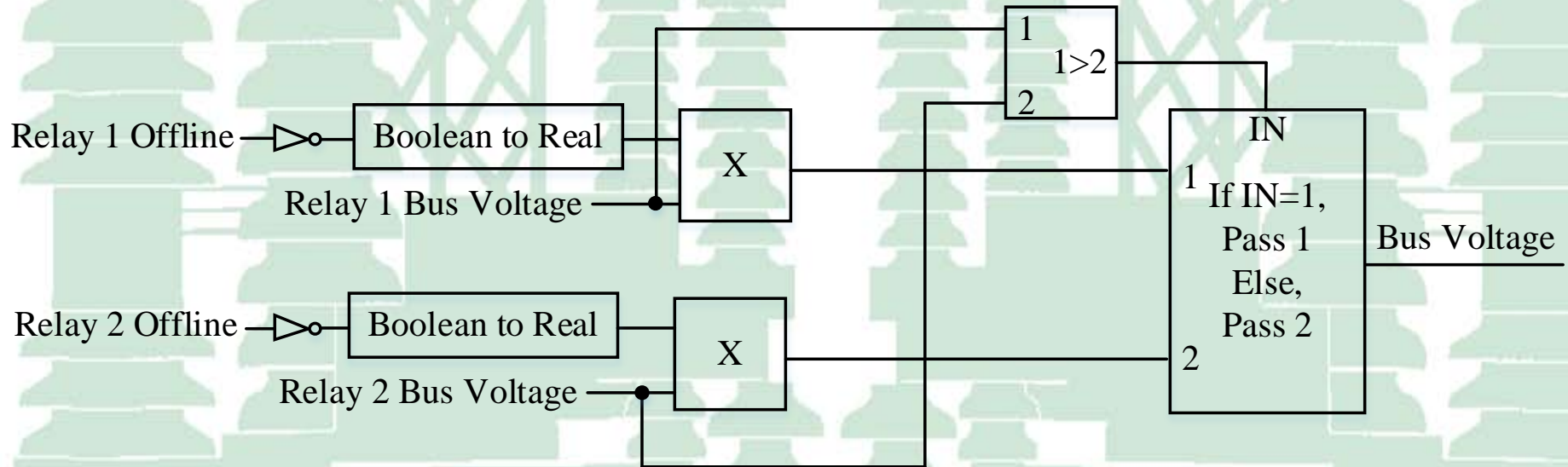
Reactive Power Control
Strategy

Conflict?

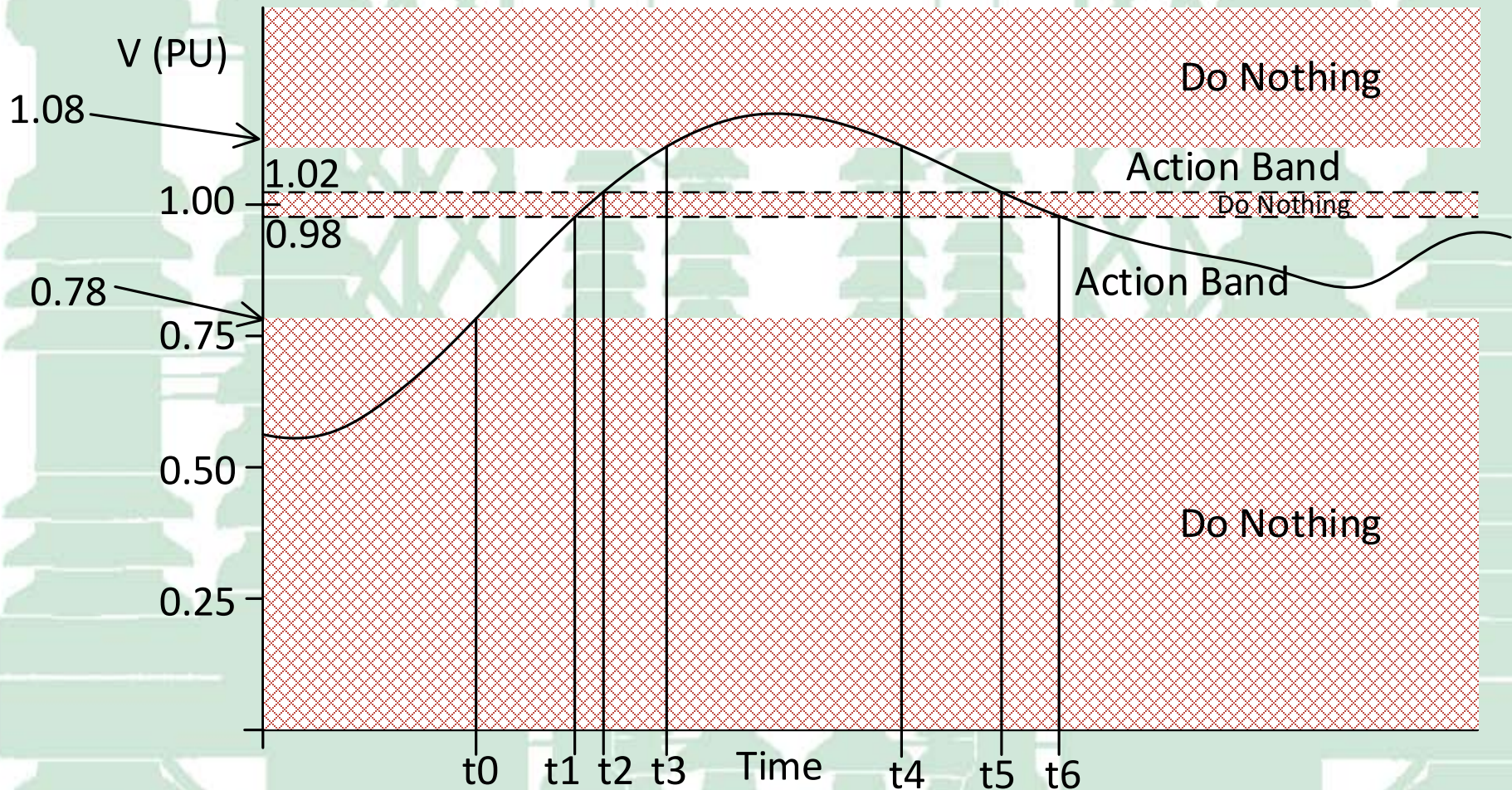
Action

Operating Parameters

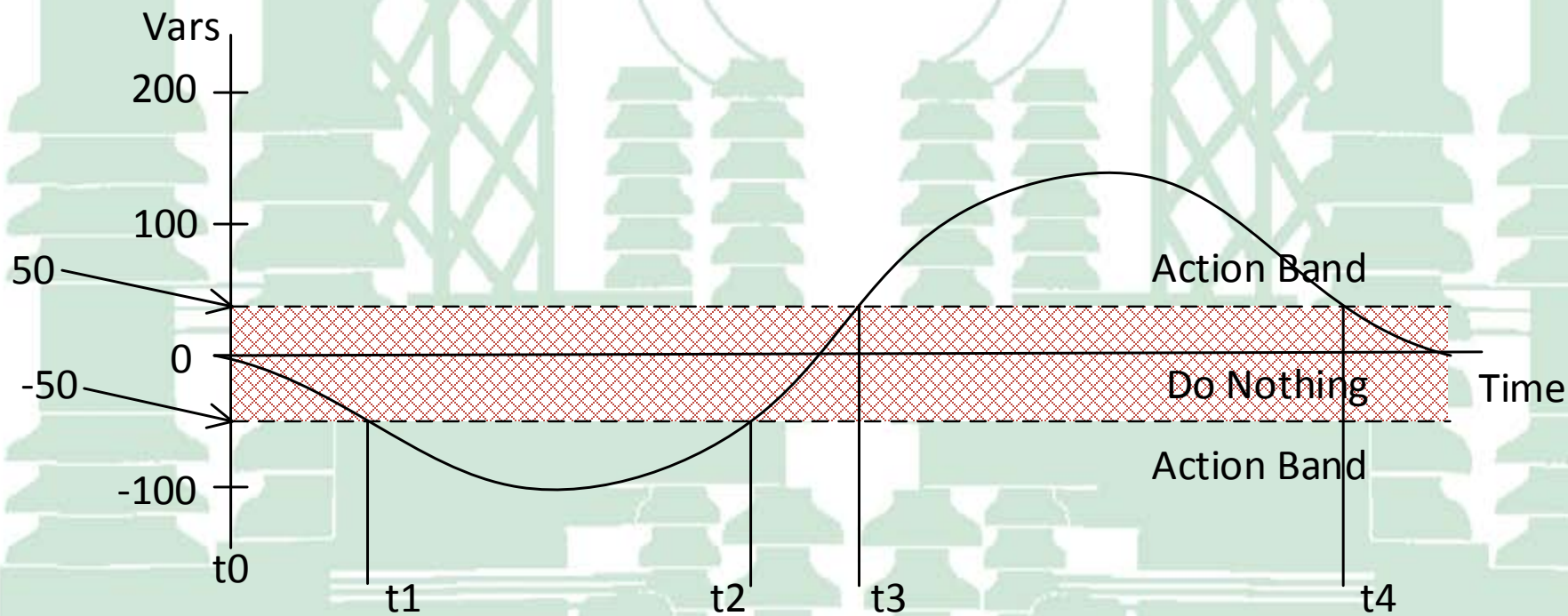
- Bus Voltage
- DRD Reactive Power Output



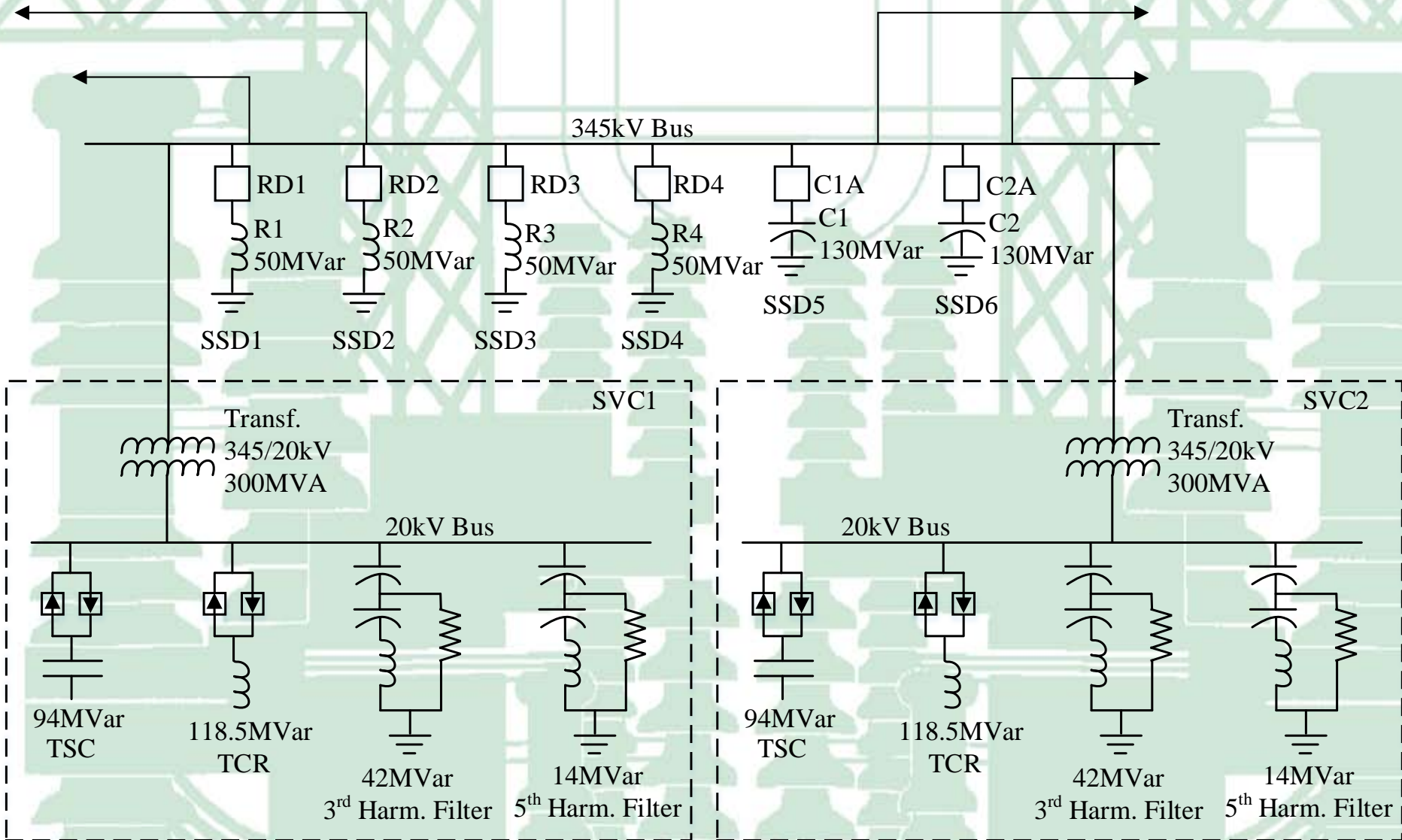
Voltage Control Strategy



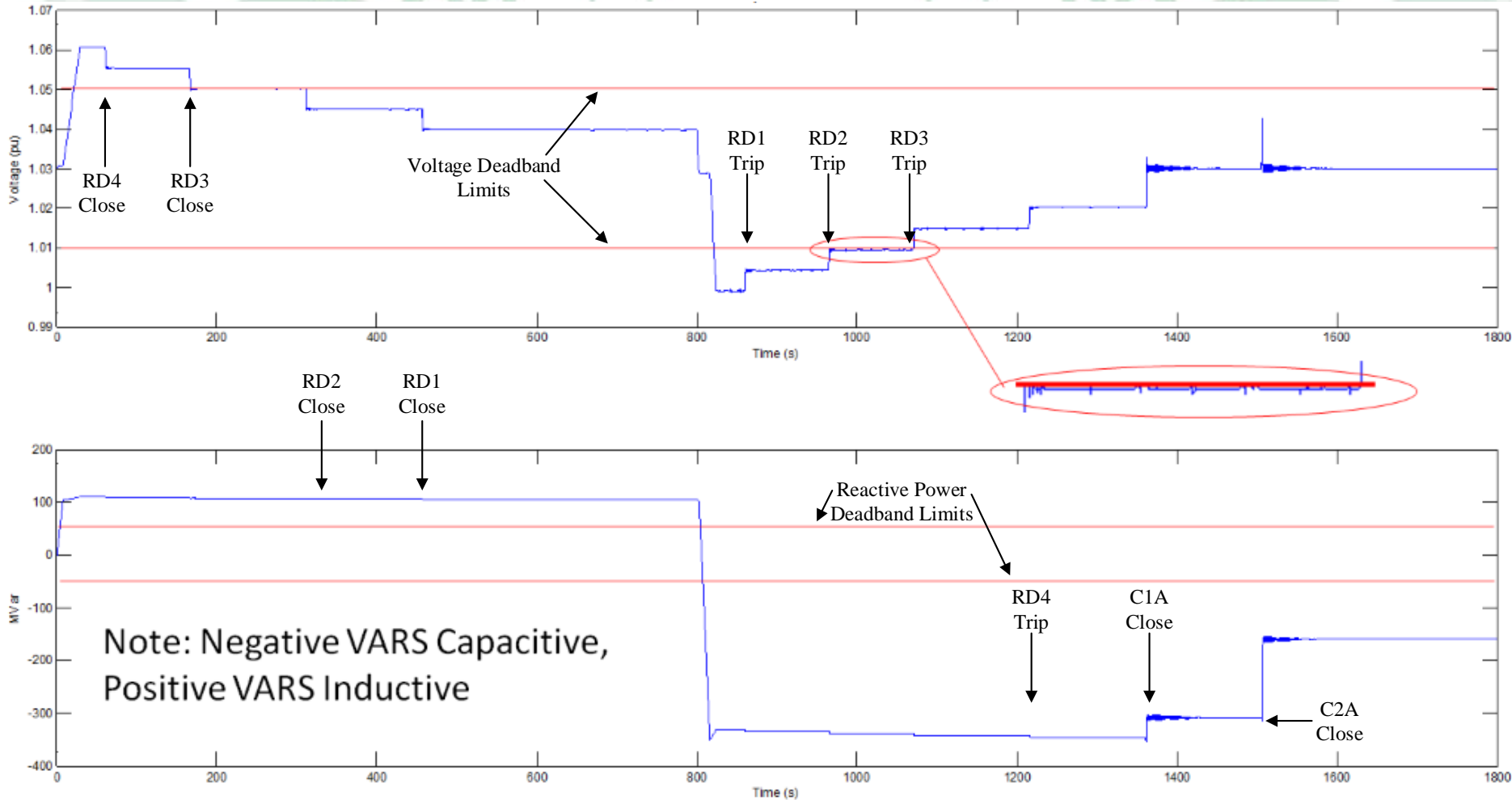
Reactive Power Control Strategy



Simulations



Simulations





System Response

345kV System Vab: 358.1 kV

CB13930: -67.0 MVar CB11170: -66.7 MVar

+ MVar = Capacitive
- MVar = Reactive

SVC

System Voltage Trend

SVC Reactive Output Trend

7238

Reactor No 1

7247

Reactor No 2

8657

Reactor No 3

9007

Reactor No 4

9557

Cap 1A

9206

Cap 2A

All Remotes RPC Enable

All Remotes RPC Disable

RPC Control Enabled RPC Enable RPC Disable

SSD Action Mode

SSD In Progress Mode

SSD Reset Mode

SSD Operation Failed Reset Failed SSD

SSD BOL Enabled Reset BOL SSD

Accelerate State Change Only Valid in Action Mode Increment Decrement

Timers	Present Value	Terminal Value
Reactive Power Increment	0 Sec.	80 Sec.
Reactive Power Decrement	80 Sec.	80 Sec.
Voltage Increment	0 Sec.	40 Sec.
Voltage Decrement	40 Sec.	40 Sec.
Progress Mode Reset	0 Sec.	65 Sec.
Reset	0 Sec.	200 Sec.

RPC Device Parameters

Reactive Deadband (+ / -) 30 MVar

High Deadband Boundary 20 MVar Increase Decrease

Reactive Midpoint -10 MVar Max Midpoint = 150 MVar Min Midpoint = 30 MVar

Low Deadband Boundary -40 MVar

VOLTAGE CONTROL

Voltage Deadband (+ / -) 0.010 V (pu %)

High Deadband Boundary 1.035 V (pu %) Increase Decrease

Voltage Midpoint 1.025 V (pu %) Max Midpoint = 1.02 pu Min Midpoint = 0.98 pu

Low Deadband Boundary 1.015 V (pu %)

Summary

- Reactive Power Controller
 - Optimizes reactive power output
 - Regulates system voltage
 - Two simultaneous control modes
- Illustrated behavior
 - Simulations
 - Actual system response
- Optimizing performance of DRD