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Subject Name: HVDC

Subject Code: EEP 424

Assignment (2) | Bipolar Point-To-Point HVDC-Link | MATLAB Model

# I. System Description:

- A 1600MW 6-pulse bipolar point-to-point HVDC-link shown below. The link interconnects between two AC networks, (network (A): 22kV/50Hz, network (B):20kV/60Hz), through overhead transmission line with a resistance of 10 Ω. The range of firing angle at the rectifier side is (5deg-25deg), while the inverter is operated under minimum γ of 20deg. 1:10 Y-Y ideal transformers with zero leakage inductances are employed. Proper smoothing reactors (Lsr) are employed as shown.

A diagram of a power line

Description automatically generated

# II. Six-Pulse Model:

## Question (A):

#### Transferring a power of 1600 MW from side (A) to side (B) during normal operating conditions. Find analytically the suitable firing angle at the rectifier side, and the corresponding dc current.

#### Transferring a power of 1200 MW from side (B) to side (A) during normal operating conditions. Find analytically the suitable firing angle at the rectifier side, and the corresponding dc current. (Assume -10% tapping at inverter side, and +10% tapping rectifier side).

#### Transferring a power of 1600MW from side (A) to side (B) during 2.5% voltage swell at network (A).

## Question (B):

### Model Screenshot:

Answer.

### Case (1): 1600MW: Power flow from (A) to (B): Net(A) is rectifier and Net(B) is inverter:

#### AC voltage at rectifier side:

Curve vs time.

#### Vdor: DC voltage at rectifier side:

Curve vs time.

#### Grid current at rectifier side:

Curve vs time.

#### AC voltage at inverter side:

Curve vs time.

#### Vdoi: DC voltage at inverter side:

Curve vs time.

#### Grid current at inverter side:

Curve vs time.

#### DC current:

Curve vs time.

### Case (2): 1200MW: Power flow from (B) to (A): Net(B) is rectifier(+10%) and Net(A) is inverter (-10%):

#### AC voltage at rectifier side:

Curve vs time.

#### Vdor: DC voltage at rectifier side:

Curve vs time.

#### Grid current at rectifier side:

Curve vs time.

#### AC voltage at inverter side:

Curve vs time.

#### Vdoi: DC voltage at inverter side:

Curve vs time.

#### Grid current at inverter side:

Curve vs time.

#### DC current:

Curve vs time.

### Case (3): 1600MW: Power flow from (A) to (B): Net(A) is rectifier(2.5% voltage swell) and Net(B) is inverter:

#### AC voltage at rectifier side:

Curve vs time.

#### Vdor: DC voltage at rectifier side:

Curve vs time.

#### Grid current at rectifier side:

Curve vs time.

#### AC voltage at inverter side:

Curve vs time.

#### Vdoi: DC voltage at inverter side:

Curve vs time.

#### Grid current at inverter side:

Curve vs time.

#### DC current:

Curve vs time.

# III. Twelve-Pulse Model:

## Question (C):

### Model Screenshot:

Answer.

### Case (1): Power flow from (A) to (B): Net(A) is rectifier and Net(B) is inverter:

#### AC voltage at rectifier side:

Curve vs time.

#### Vdor: DC voltage at rectifier side:

Curve vs time.

#### Grid current at rectifier side:

Curve vs time.

#### AC voltage at inverter side:

Curve vs time.

#### Vdoi: DC voltage at inverter side:

Curve vs time.

#### Grid current at inverter side:

Curve vs time.

#### DC current:

Curve vs time.

### Case (2): 1200MW: Power flow from (B) to (A): Net(B) is rectifier(+10%) and Net(A) is inverter (-10%):

#### AC voltage at rectifier side:

Curve vs time.

#### Vdor: DC voltage at rectifier side:

Curve vs time.

#### Grid current at rectifier side:

Curve vs time.

#### AC voltage at inverter side:

Curve vs time.

#### Vdoi: DC voltage at inverter side:

Curve vs time.

#### Grid current at inverter side:

Curve vs time.

#### DC current:

Curve vs time.

### Case (3): 1600MW: Power flow from (A) to (B): Net(A) is rectifier(2.5% voltage swell) and Net(B) is inverter:

#### AC voltage at rectifier side:

Curve vs time.

#### Vdor: DC voltage at rectifier side:

Curve vs time.

#### Grid current at rectifier side:

Curve vs time.

#### AC voltage at inverter side:

Curve vs time.

#### Vdoi: DC voltage at inverter side:

Curve vs time.

#### Grid current at inverter side:

Curve vs time.

#### DC current:

Curve vs time.

# IV. Comparison:

### Question (D):

#### Compare the performance of 6-pulse and 12-pulse converters. Comment.

Answer.

# V. Attachments:

* [GitHub repo.](https://github.com/Tasnime1/HVDC-model)