B22228

Q: Using the given data, perform load flow analysis on 30 bus system using the Newton Raphson method and answer the questions listed in the

Consider with an initial injected Mvar of 4.23 at bus 24. Modify the injecting Mvar to 9 at the same bus. What is the effect of this injected Mvar on the voltage at bus 10? Explain the reasons for observed differences.

| Power Flow Solution | | | | | |
|---|---|---|---|---|---|
| | No. of | Line losses | Total Load | Total Generation | Injected Mvar |

| Maximum Power Mismatch | iterations | MW | Mvar | MW | Mvar | | Mvar | |
|---|---|---|---|---|---|---|---|---|
| 7.54872e-07 | 4 | 17.600 | 22.250 | 283.400 | 126.200 | | 301.000 125.220 | 23.230 |
| 7.58348e-07 | 4 | 17.542 | 21.911 | 283.400 | 126.200 | | 300.942 120.111 | 28.000 |

Magnitud of volatage at 4.23 injected MVAR = 1.044

Magnitud of volatage at 9 injected MVAR= 1.048

**Explanation:**

1. Reactive Power (Mvar) and Voltage Relation:
    - Reactive power injections (Mvar) directly affect voltage magnitudes in a power system. When you inject more reactive power into the system, it generally leads to an increase in voltage at the bus where the power is injected.
    - Voltage Support: Injecting Mvar helps support and boost voltages, especially in systems where the voltage might be sagging due to high reactive power demand or losses.
2. Effect on Nearby Buses:
    - Bus 24, where the Mvar injection occurs, will see a direct impact. The reactive power injection at this bus will increase its voltage and the voltages of nearby buses.
    - Bus 10 is indirectly affected by the change at bus 24, and this is reflected in the observed voltage increase from 1.044 p.u. to 1.048 p.u..
3. Small Voltage Difference:
    - The increase in voltage at bus 10 is relatively small (from 1.044 to 1.048 p.u.), which suggests that bus 10 is not immediately adjacent to bus 24, or that the system's impedance between these buses is relatively high.
    - This means that while bus 10 is impacted by the injection at bus 24, the effect is somewhat mitigated due to electrical distance and network topology.

4. Reason for the Change:
    - The reason for the observed voltage change is that the injected reactive power at bus 24 increases the overall reactive power available in the system. This additional reactive power helps to increase the voltage levels across the grid, particularly at nearby buses like bus 10, although the effect diminishes with distance.

**Summary of the Effect:**

- Initial Injection: 4.23 Mvar at bus 24, resulting in 1.044 p.u. voltage at bus 10.
- Increased Injection: 9 Mvar at bus 24, resulting in 1.048 p.u. voltage at bus 10.

The voltage at bus 10 increased due to the larger amount of reactive power injected into the system at bus 24. The change in voltage is minor because bus 10 is likely farther from bus 24, meaning the reactive power influence diminishes as it moves through the system.