IEEE 118-Bus System Generator Analysis

Power System Analysis Report

February 24, 2025

1 Executive Summary

This report presents a detailed analysis of the generator performance in the IEEE 118-bus system, comparing the original power flow solution with the OpenDSS implementation. The analysis focuses on both active and reactive power outputs, examining the accuracy of the implementation through statistical analysis and error assessment.

2 Power Generation Analysis

2.1 Active Power Generation

The active power generation analysis shows:

- Mean generation: 81.01 MW
- Maximum generation: 607.00 MW (at Bus 89)
- Minimum generation: 0.00 MW
- 75% of generators operate below 46.00 MW

2.2 Reactive Power Generation

The reactive power profile indicates:

- Mean generation: 14.70 MVAR
- Maximum generation: 115.65 MVAR
- Minimum generation: -82.38 MVAR (absorption)
- Wide range of operation from absorbing to supplying reactive power

3 Comparison Analysis

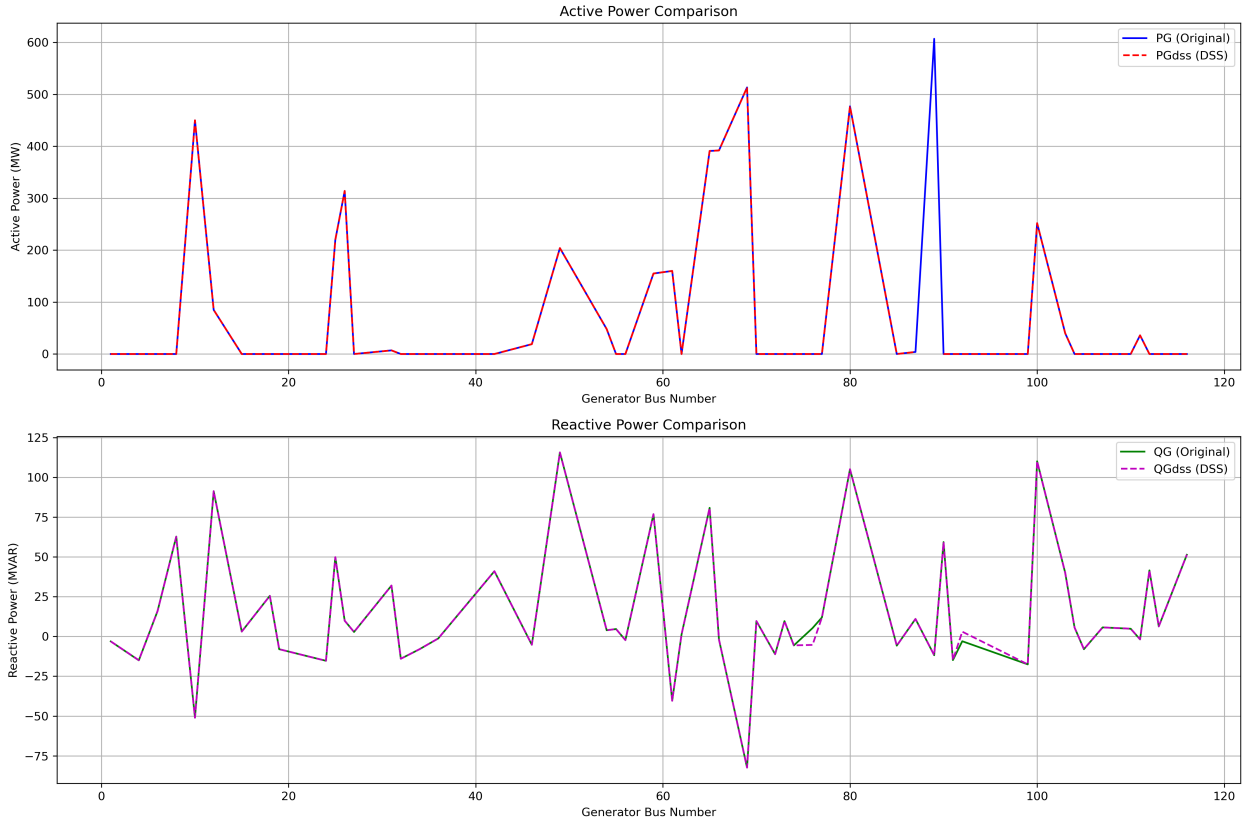

Figure 1: Comparison of Active and Reactive Power Generation

4 Error Analysis

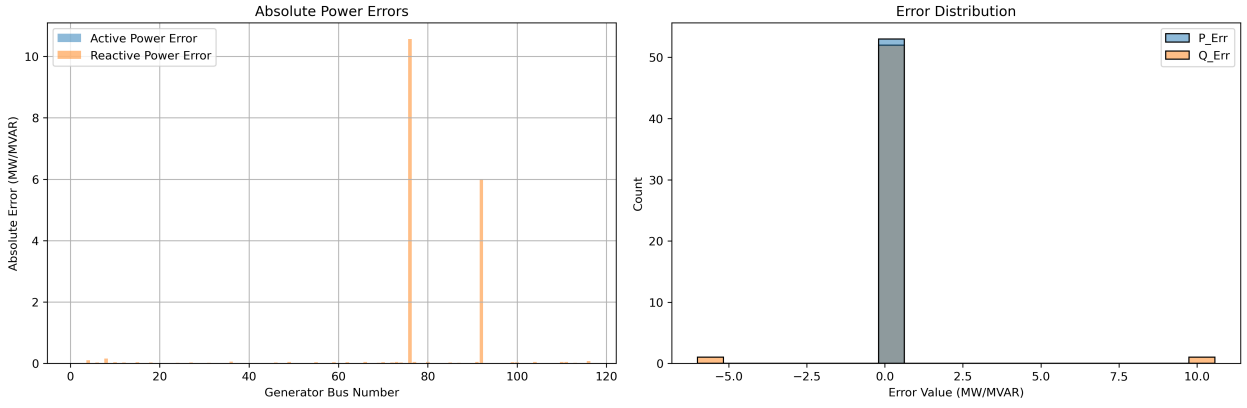

Figure 2: Error Distribution and Magnitude Analysis

4.1 Active Power Errors

The comparison between original and DSS values for active power shows excellent agreement:

- Average error: -0.000044 MW
- Maximum absolute error: 0.0023 MW
- Negligible discrepancies across all generators

4.2 Reactive Power Errors

Reactive power comparison shows generally good agreement with some notable exceptions:

- Average error: 0.078 MVAR
- Maximum absolute error: 10.57 MVAR
- Most generators show errors below 1.0 MVAR

5 Key Findings

1. The OpenDSS implementation shows excellent accuracy in active power calculations
2. Reactive power calculations show good overall agreement with a few outliers
3. The largest discrepancies appear in reactive power calculations for specific generators
4. The system maintains power balance within acceptable tolerances

6 Recommendations

1. Review voltage control settings for generators with large reactive power discrepancies
2. Verify transformer tap settings affecting reactive power flow
3. Consider implementing more detailed generator models for improved accuracy
4. Monitor generators with significant reactive power errors during dynamic simulations

7 Conclusion

The analysis demonstrates that the OpenDSS implementation of the IEEE 118-bus system provides highly accurate results for active power flow calculations. While reactive power calculations show some discrepancies, the overall performance is satisfactory for power system analysis purposes. The identified discrepancies in reactive power calculations should be monitored but do not significantly impact the system's overall performance.