249. A Local-Central Combined Voltage Control Method of PV Inverters in Distribution Networks

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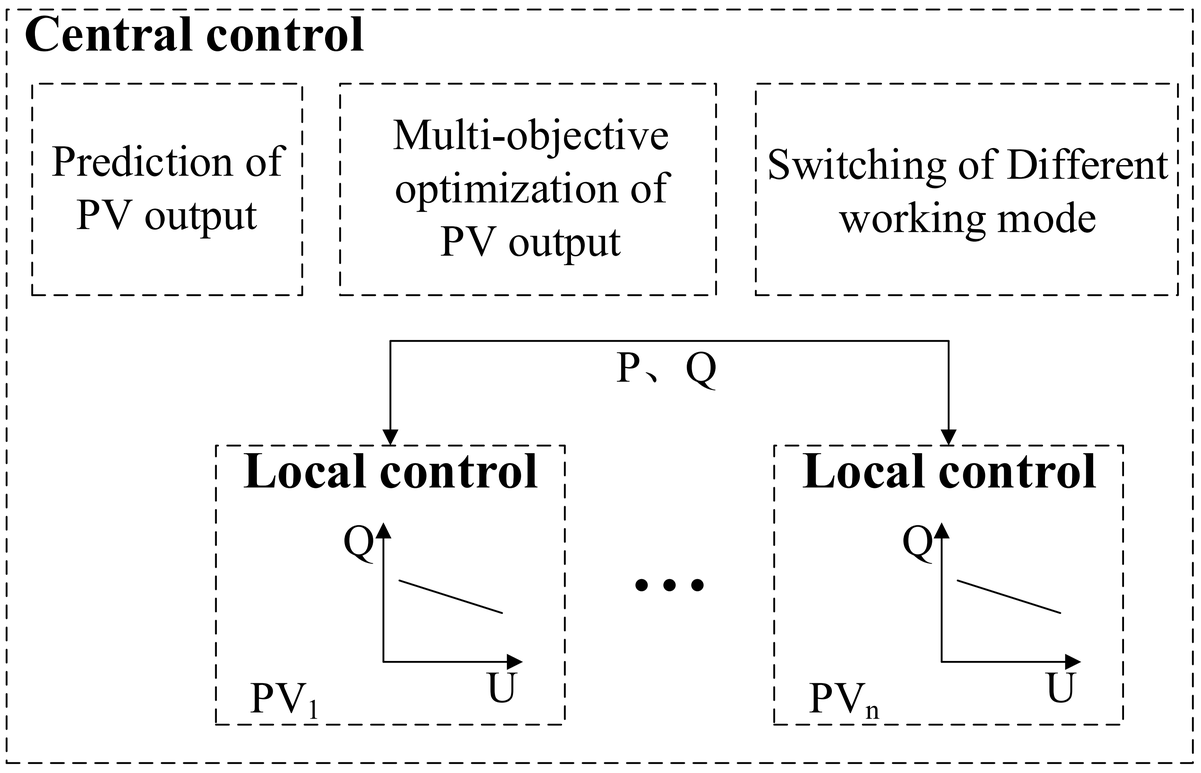
Background

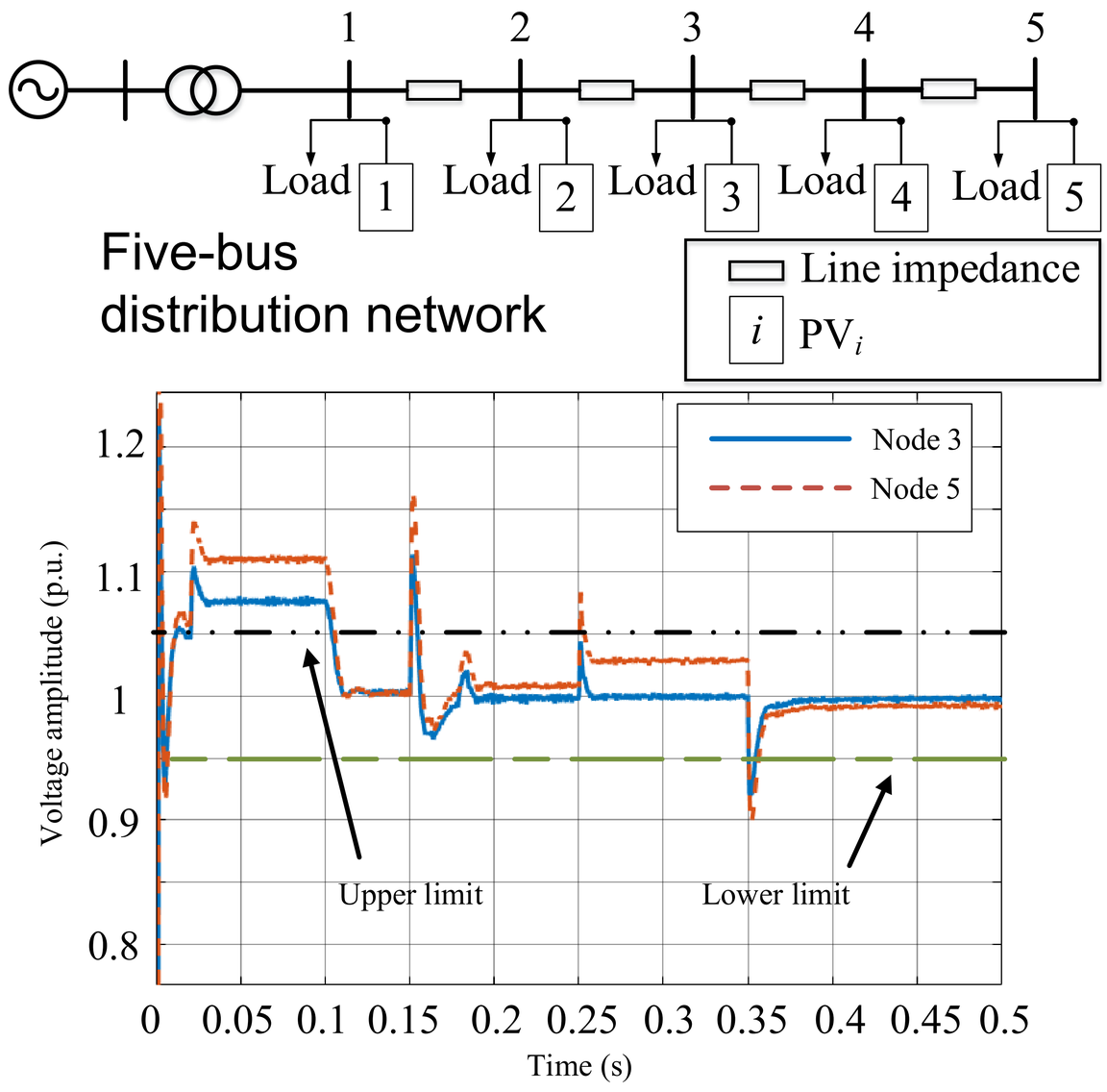
With the increasing scale of distributed photovoltaics (PVs) accessed to distribution networks, surplus power will be injected into the distribution network as PV power outputs exceed local load demands, which causes serious voltage violation problems. However, this violation problem could be eliminated by PV inverters themselves due to their fast and flexible adjustment of active and reactive power outputs. In this article, a novel voltage control structure combining the local and central control of PV inverters is proposed to address the voltage violation in the distribution network with scattered PVs.

Voltage Control Method



In this method, Q-U droop controller is used in local voltage control, it can adjust the node voltage quickly. As for the central voltage control, back propagation (BP) neural network and genetic algorithm (GA) are applied to calculate the optimal output of PV inverter to improve the effectiveness of the voltage adjustment.

Case Study by Simulation



Voltage amplitude of node 3 and node 5

Conclusion

This article proposes a local-central combined voltage control method to solve the problem of voltage violation caused by PVs in the distribution network. Based on the analysis of voltage regulation with PVs, the structure of local-central combined voltage control method is built. Then the forecast of PV output, the optimization method based on GA for switching of PV control states and the control of real-time active and reactive power outputs are employed as the central control strategy. Combined with the local Q-U droop control strategy, the effectiveness and feasibility of the control method are verified by a five-bus structure in MATLAB/Simulink. The result shows that all these bus voltages can be controlled within the specified range with the proposed control method.