New Perspectives on Droop Control in AC Microgrid

ABSTRACT

Virtual impedance, angle droop and frequency droop control play important roles in maintaining system stability, and load sharing among distributed generators (DGs) in microgrid. These approaches have been developed into three totally independent concepts, but a strong correlation exists. In this letter, their similarities and differences are revealed. Some new findings are established as follows: 1) the angle droop control is intrinsically a virtual inductance method; 2) virtual inductance method can also be regarded as a special frequency droop control with a power derivative feedback; 3) the combination of virtual inductance method and frequency droop control is equivalent to the proportional–derivative (PD) type frequency droop, which is introduced to enhance the power oscillation damping. These relationships provide new insights into the design of the control methods for DGs in microgrid.

KEYWORDS

1. Microgrid
2. Droop control
3. Virtual Impedance

SOFTWARE: MATLAB/SIMULINK
BLOCK DIAGRAM:

![Block Diagram](image)

Fig. 1 Equivalent output voltage source considering virtual impedance.

EXPECTED SIMULATION RESULTS:

![Graphs](image)

Fig. 2 Power response during load change in conventional frequency droop. (a) Active power, (b) reactive power.
Fig. 3 Power response during load change in frequency droop plus virtual reactance. (a) Active power, (b) reactive power.

Fig. 4 Power response during load change in modified frequency droop. (a) Active power, (b) reactive power.
CONCLUSION

This letter compares the similarities and differences among three different concepts, virtual impedance method, angle droop and frequency droop control. Although each of them has been well researched, new perspectives are bought to readers by relating all three together. Thus, the inherent relationships are established, and new insights into the controller design are provided. Finally, the modified droop control unifies these three independently developed droop control methods into a generalized theoretical framework. To the reader, this letter explores the possibilities of further enhancing the existing methods and inspiring the development of new methods.

REFERENCES