

Comparison between modal analysis and impedance-based methods for analysing stability of unbalanced microgrids with grid-forming electronic power converters

S.J. Yagüe Yagüe; A. García Cerrada; P. Palacín Farré

Abstract-

Stability in unbalanced power grids have deserved little attention in the literature. Given the importance of this scenario in distribution systems with distributed generation, this paper revisits modal analysis techniques for stability studies in power systems, and explains how to tackle unbalanced systems with voltage-dependent loads. The procedure is described in detail and applied to a Low Voltage (LV) simple case study with two grid-forming electronic power converters and unbalanced loads. Results are then compared with those obtained with the popular impedance-based method. While the latter is easier to implement using simulation or field data, the former requires complete information of the system, but gives a better insight into the problem. Since both methods are based on a small-signal approximation of the system, they provide similar results, but they discern different information. A larger second case study based on an LV CIGRE distribution system is also analysed. Results are obtained using a detailed SIMULINK model of the microgrids with electronic power converters.

Index Terms- Stability, microgrids, modal analysis, impedance based method, unbalanced distribution systems.

Due to copyright restriction we cannot distribute this content on the web. However, clicking on the next link, authors will be able to distribute to you the full version of the paper:

[Request full paper to the authors](#)

If your institution has an electronic subscription to Journal of Modern Power Systems and Clean Energy, you can download the paper from the journal website:

[Access to the Journal website](#)

Citation:

Yagüe, S.J.; García-Cerrada, A.; Palacín Farré, P. "Comparison between modal analysis and impedance-based methods for analysing stability of unbalanced microgrids with grid-forming electronic power converters", Journal of Modern Power Systems and Clean Energy, vol.11, no.4, pp.1269-1281, July, 2023.