Improved Step Size Newton Raphson Method using quadratic equations properties in ill-conditioned power system

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SUMMARY

The Step Size of the Newton Raphson Method (SSNRM) is based on the optimal multiplier that is used to determine the Multiple Load Flow Solutions (MLFS) for an ill-conditioned power system. However, the SSNRM is incapable of determining the desirable Low Voltage Solution (LVS) from the MLFS at the Maximum Loading Point (MLP), due to the fact that when the load demand increases, the LVSs moves closer to each other at the MLP. Commonly, the smallest optimal multiplier was used to calculate the LVS at the MLP under this condition. However, this paper proves the fact that using the smallest optimal multiplier to determine the most suitable LVS for the systems having multiple solutions at the MLP will not guarantee a favourable outcome. Therefore, this paper investigates the application of the properties of scalar quadratic equations (PSQE) that enhances the function of the SSNRM at the MLP. Thus, an indicator, based on PSQE, is introduced in this work, which amends the existing SSNRM for the purpose of finding the desirable LVS at the MLP. The closest optimal multiplier to the proposed indicator is selected in order to determine the desirable LVS from all possible solutions at the MLP. The proposed method has been tested on a three-bus and IEEE 30-bus systems at the MLP for verification purposes. Additionally, the continuation power flow method is also utilized in order to compare it to the proposed method for the IEEE 30-bus.