Quadratic Discriminant Index for Optimal Multiplier Load Flow Method in ill conditioned system

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ABSTRACT

In ill conditioned power systems, the classical Optimal Multiplier Load Flow Method (OMLFM) can only calculate Low Voltage Solutions (LVS) at the vicinity of the maximum loading point (MLP). It cannot determine the boundary zone between solvable and unsolvable cases of load flow equations solution. Considering this limitation, this paper proposed the Quadratic Discriminant Index (QDI) based on the properties of quadratic form of load flow equations to enhance OMLFM to find LVS at the MLP in polar coordinate form. These properties can describe all straight lines through two distinct state variables solution as Multiple Load Flow Solutions (MLFS) in OMLFM. The trajectory of these lines approaches MLP in term of loading factor. Furthermore, in this process, MLP in well, ill and unsolvable operation zones can also be determined. The test results of a single-machine system and IEEE 14, 57 and 118-bus test systems demonstrate the validity of the proposed method.

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