Power System Observability of Phasor Measurement Units: A Binary Integer Programming Approach

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Abstract

In this paper, the allocation problem of Phasor measurement units (PMU) is solved using a binary integer programming (BIP) method. The proposed approach aims to minimize the total number of PMUs that can achieve full system observability. Defining N as the number of system buses, the full system observability is ensured both in normal operating conditions and in case of N-1 contingencies such as the outage of a PMU or a transmission line. Moreover, the approach is utilized to allocate the PMUs in case of limited number of PMU channels. The problem formulation considers the Zero Injection Buses (ZIBs) and uses a set of rules that can improve the redundancy of the PMUs by choosing better locations without increasing their number. The proposed approach is applied to the IEEE standard systems 14, 30 and 57 test systems. The simulations results are compared with other approaches used in the literature to validate the effective performance of the proposed approach.

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