

# **Improving AGC performance in power systems with regulation response accuracy margins using Battery Energy Storage System (BESS)**

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**Abstract-** With the steady expansion of renewable energy sources (RES), the provision of ancillary services is becoming an increasingly challenging task within system operation. In order to add regulation capacity, battery energy storage systems (BESS) have been recognized as an efficient tool in recent literature. In this context, this paper proposes a novel BESS control strategy to improve dynamic performance of automatic generation control (AGC). Such control strategy is applicable to power systems which evaluate AGC performance utilizing regulation response accuracy margins, which typically define the slowest and fastest permitted power response to a regulation signal. The primary goal consists in enhancing the regulation service by minimizing the rate of non-compliance with respect to the corresponding dynamic performance criteria and its defined accuracy margins. Additionally a comprehensive State-of-Charge-control (SoC-control) is included in the strategy. By utilizing the BESS only during designated regulation assistance periods, preventing extreme levels of charge and furthermore identifying and avoiding futile regulation efforts, BESS degradation is kept to a minimum. To verify effectiveness a case study is conducted with 400 hours of real AGC operation of various BESS sizes. The obtained results show that a BESS is able to minimize the rate of non-compliance considerably, whilst preserving low BESS usage and degradation.

**Index Terms-** Secondary frequency regulation, Automatic Generation Control, Regulation performance, Battery Energy Storage System, State of Charge, Throughput.

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