

Sizing and controller setting of ultracapacitors for frequency stability enhancement of small isolated power systems

L. Sigrist, I. Egado, E. Lobato, L. Rouco

Abstract— This paper studies the impact of the size and controller settings of an ultracapacitor (UC) on frequency stability. Underfrequency load-shedding (UFLS) schemes play an important role in protecting the system against frequency instability and their performance is used as a measure for the enhancement of frequency stability thanks to the UC. To this end, a simplified but still accurate model of the UC is developed. In addition, a meaningful procedure is proposed to size the UC's power and energy storage capacities in function of the system parameters and operation constraints in order to improve frequency stability. Finally, the impact of the UC on the UFLS scheme is studied for many generation dispatch scenarios and for all possible single generating unit outages of a Spanish isolated power system. An analysis with respect to the UC's control parameters and its size in terms of power and energy storage capacities is carried out, too. Appropriate control parameter settings improve the UC's impact on frequency stability.

Index Terms— Frequency stability, load shedding, power system protection, ultracapacitor.

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