

Troubleshooting a digital repetitive controller for a versatile dynamic voltage restorer

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Abstract— Voltage sags and swells, voltage harmonics and voltage imbalances in power systems may affect sensitive loads causing production interruption or equipment damage. Nowadays, series voltage compensation using power electronics devices is a promising solution for these problems and the design, control and application of this type of devices have drawn much attention in the literature. Comprehensive controllers for Dynamic Voltage Restorers (DVR's) have already been proposed to tackle all those problems simultaneously with promising simulation results. However, several implementation aspects need closer attention and are addressed in this paper. The proposed controller is divided into a main one and an auxiliary one. The former is based on a state-feedback controller to achieve a fast transient response when voltage sags occur. The latter uses a repetitive controller to improve steady-state reference tracking and disturbance rejection in order to tackle harmonic and imbalance problems. This paper focuses on the repetitive-controller part. Firstly, the full digital implementation of the controller is presented. Secondly, a new method to improve the repetitive controller performance with small frequency deviations in the grid is discussed. Thirdly, strategies to avoid internal instability problems not detected in the previous literature are studied. Finally, the main contributions of the paper are tested on a 5 kVA prototype.

Index Terms— Voltage control; DVR; Series Active Conditioners; Active filters; Harmonics; Repetitive control

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