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DOUBLE DIGITAL CONTROL FOR ROBUST UPS INVERTER SYSTEMS AGAINST PARAMETER CHANGE

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Abstract. *We propose a novel digital control system for uninterruptible power supply (UPS) inverter systems based on a double control loop composed of an outer voltage and an inner current control loop. The proposed control scheme compensates for undesirable overshoot and oscillations due to computational time delay by including the time delay term in the transfer function of the current control loop. The inner current control is a modified internal model scheme designed via a second-order deadbeat response. The response reaches a predefined reference level within two sampling time intervals, including the calculation time delay. The outer voltage control loop uses proportional-resonance (P-R) control to achieve robust control against parameter change. A resonance controller has an infinite gain at the resonant frequency and its frequency is considered as fundamental frequency for reference voltage. Thus, an outer voltage control loop has zero steady-state error with respect to both magnitude and phase. We demonstrate the applicability and effectiveness of the proposed control system through computer simulation and experimental results.*

Keywords: UPS inverter, Double control loop, Internal model controller, Second-order deadbeat response, P-Resonance controller

1. **Introduction.** Uninterruptible power supply (UPS) systems provide reliable and stable electrical power in industrial applications that are sensitive to deterioration in the quality of the supply power. These include a variety of applications such as: computers, factory automation systems, electronic equipments, and communication systems. The underlying objective of UPS systems is to provide a sinusoidal voltage of constant magnitude and frequency despite power supply failure or malfunction.

Most UPS control approaches are constructed using two control loops: an inner current loop and an outer voltage loop [1]. The current control loop is particularly important in determining the transient response of the UPS system. The outer voltage loop is critical for providing the UPS system with robustness with respect to parameter change.

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