This paper presents a unified structure of the unbalanced synchronous reference current control strategies for single-phase grid-tied voltage-source converters to obtain a zero steady-state error in the line current. An arbitrary waveform is used as the orthogonal current for the stationary to rotating frame axis transformation of the reference and measured grid currents. Various choices of such orthogonal signals lead to different control structures with the same performance characteristics. This causes a temporary unbalanced system, in which double-line frequency components appear in the control loops during the transient state. The proposed method with cross-axis decoupling, tuned at the control loop bandwidth by greater than eight times the grid frequency, has better performance than the existing virtual balanced synchronous reference frame scheme. Absence of the orthogonal signal generation guarantees the stability criterion of the control scheme. A zero steady-state error is still achieved under conditions of uncertainty in the converter parameters. Simulation and experimental results of a 1.5-kVA pulse width modulation rectifier validate the proposed methodology.