

New Techniques in the Design of Distributed Power Systems

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(ABSTRACT)

Power conversion system design issues are expanding their role in information technology equipment design philosophies. These issues include not only improving power conversion efficiency, but also increased concerns regarding the cost and complexity of the power conversion design techniques utilized to satisfy the host system's total performance requirements. In particular, in computer system (personal computers, workstations, and servers) designs, the power "supplies" are rapidly becoming a limiting factor in meeting overall design objectives.

This dissertation addresses the issue of simplifying the architecture of distributed power systems incorporated into computing equipment. In the dissertation's first half, the subject of the design of the distributed power system's front-end converter is investigated from the perspective of simplifying the conversion process while simultaneously improving efficiency. This is initially accomplished by simplifying the second-stage DC/DC converter in the standard two-stage front-end design (PFC followed by DC/DC conversion) through the incorporation of secondary-side control. Unique modifications are then made to two basic topologies (the flyback and boost converter topologies) that enable the two-stage front-end design to be reduced to an isolated PFC conversion stage, resulting in a front-end design that features reduced complexity and higher efficiency.

In the dissertation's second half, the overall DC distributed power system design concept is simplified through the elimination of power processing conversion steps - the

result being the creation of a high-frequency (HF) AC distributed power system. Design techniques for generating, distributing, and processing HF AC power in this new system are developed and experimentally verified. Also, an experimental comparison between both DC and AC distributed power systems is performed, illustrating in a succinct fashion the merits and limitations of both approaches.

“Are you coming home tonight Daddy?”

“Yes baby, I am.”

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