Digital Interleaved PWM for Envelope Tracking Converters

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Abstract

The bandwidth of a switched power converter is limited by Nyquist sampling theory. Further, switching frequency and the filtering structures of the converter are further limited to maintain high efficiency, low cost and size. A solution around this is to interleave power stages. Interleaving with analog PWM is well understood and used widely. This presentation will focus on digital PWM interleaving which makes it possible to get large usable bandwidth at relatively low switching frequencies. The mapping of the input signal to the different interleaved stages varies with the signal level and is nontrivial. Interleaving schemes with two, three and four switches will be demonstrated. Digital PWM created by counting a high-speed clock has quantized duty ratios. The integral of these quantization errors can add up to large offsets in the currents in the interleaved stages. A scheme is introduced to eliminate current offsets without any feedback from the power stage. Simulation results will be shown for a dual interleaved system tracking single-tone signals and an LTE-20 envelope. Higher order interleaving can provide even greater tracking bandwidth at lower switching frequencies.

Biography

Pallab Midya received a Ph.D. in Electrical Engineering from the University of Illinois at Urbana Champaign, an M.S. in Electrical Engineering from Syracuse University, and a B.Tech. in Electronics & Electrical Communication Engineering from the Indian Institute of Technology at Kharagpur, India. He has about forty publications, thirty-nine issued US patents and another nine patents pending. He was a Distinguished Member of the Technical Staff at Motorola Labs and at Freescale Semiconductor. Since 2009 he has been president of ADX Research, Inc. which provides intellectual property and technical consulting in the areas of analog and digital PWM switchers for envelope tracking, class D audio amplifiers, and high performance power conversion all the way to TerraHertz frequencies. Clients include major semiconductor companies as well as startups. At this time, he is also putting together a small engineering team in the Chicago suburbs to pursue a green technology opportunity.