Aspects of Digital PWM Audio Power Amplifiers

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ABSTRACT

In 1998, the digital PWM audio power amplifier “Millennium” from Tact Audio was introduced on the market. According to the “Guinness Book of World Records 1999” this was the first fully digital PWM audio power amplifier. Since then, a number of semiconductor companies have put effort in implementing digital PWM audio power amplifiers on integrated circuits to reduce cost and size of the systems.

When implementing a digital PWM amplifier system on integrated circuits, many challenges arise e.g. with respect to performance, system control, robustness and reliability. Some of these issues are treated in the present dissertation, including the following results:

- A novel method is presented for active reduction of the undesired transients occurring when starting or stopping the modulation. The method uses shaping of the spectral content of the transients and hereby the disturbance is reduced in the inband frequency range.
- A novel method is presented for reduction of the undesired transients occurring when stopping a signal, quantized by use of noise shaping. This method proposes a synchronized stop of the quantized signal, controlled by means of a detector to reduce the disturbance.
- A novel method is presented for adaptive digital calibration of over sampled data converter systems. The calibration method is suited for mitigation of analog related errors in all types of over-sampled D/A and A/D converters, including PWM, multi-bit and 1-bit systems.

The results, all enables cost efficient improvements of the technology in the field of digital PWM systems and some of the results have served as a basis for practical improvements implemented on integrated circuits. Furthermore, most of the results are generic and might be useful in other fields of signal processing.