Low-Power, Low-Voltage Analog to Digital \( \Sigma \Delta \) - DTU Orbit (09/11/2019)

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This thesis is the result of three years of research in the field of integrated analog electronics. The research was carried out by Ulrik Wismar as part of the work leading to the PhD title. It is expected that the reader is familiar with basic semiconductor theory. The topic of this work is various implementations of audio band modulators used as CMOS analog to digital converters. The intended application is hearing aids where analog to digital converters are used to convert the preamplified signal from a microphone into a digital signal which is fed into a microprocessor. A hearing aid is battery driven, and since long operation time is required, low supply voltage and low power consumption are of paramount importance. Consequently, various topologies have been compared to find the most power efficient audio frequency modulator topology. Chapter 4 of this thesis compares power consumption of two of the most prevalent topologies, the single-loop modulator with integration in discrete time and the single-loop modulator with integration in continuous time. Both modulator topologies are with feedback, and all intermediate signals are in the voltage mode. Chapter 5 treats a modulator without feedback. Another difference between the modulators described in the two chapters is that the voltage input signal is frequency modulated and handled in the frequency mode internally in the modulator. For the feedback modulators, the results are based on simulation, whereas the part about modulators without feedback is based on measurements on two prototypes.

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