DIGITAL TECHNIQUES IN DELTA MODULATION

BY

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SUMMARY

During the last twenty years delta modulation has received considerable attention as a simple but inefficient method of coding analogue signals into binary signals. Companding is used to improve the efficiency of the delta modulation process, but it gives added complexity to the hardware, so that a compromise is usually made between the performance and complexity of the delta modulator.

Recently, with the advent of integrated circuit (IC) technology it became apparent that firstly, the hardware was becoming cheaper and secondly, the cost of the IC was not strictly related to the complexity of the IC, but rather to the number of IC's made.

Because the input to the demodulator is a binary signal delta modulation is ideally suited to the use of digital techniques in the demodulation process. Further advantages of digital techniques are; stability, noise immunity, tolerance to power supply and temperature variations, a higher yield during the manufacture of the IC and the ability to reproduce exactly the same signal at two different locations.

An efficient and therefore complex delta modulator, using digital techniques, will thus in the near future be a economical proposition.

This thesis is mainly concerned with the development of delta modulators using the above features. Furthermore
the delta modulators are specifically designed for speech transmission in telephone applications.

Two delta modulators are described in the thesis, one using instantaneous companding, the other using syllabic companding. It will be shown that the use of digital techniques in instantaneous companding can achieve a better transmission error performance, an improved stability, a wider dynamic range and a better matching of the companding laws at the transmitter and the receiver than can be obtained by using analogue methods.

The use of digital techniques in syllabic companding enables the dynamic range to be chosen at will. The syllabic companded delta modulator described in this thesis has a 60dB companding ratio which is far more than can be obtained using analogue methods. Furthermore, digital techniques enable the modulation depth to be determined accurately, so that the companding takes place at the optimum performance of the modulator.

Computer simulation was used to optimize the delta modulators when speech is used as input.