Abstract

The concept of active noise control was known in the 1960s, several solutions were proposed to the problem. The author of one of the first solutions [3] is Widrow, which was published in 1975. The main idea behind his approach is that the noise can be controlled with a special (LMS) filter which adapts to the changes in the environment to maximise the noise reduction. After he published his paper several researchers started to work on the topic, many improvements were published of the original method. One of these is called the filtered LMS [10] algorithm which models a new signal path to improve the stability of the system. The filtering and adaption steps are requiring devices with high computational capacity, but these were not available at the time so active noise cancellation based on adaptive filters was not used extensively.

With the advent of modern digital signal processors it became possible to implement the algorithm in portable devices, mainly in headphones, but the production cost of these gadets are still quite high. Some of the currently available consumer headphones contain an active noise controlling circuitry with only a few parts. It is not known precisely how these work because the manufacturers are keeping this information from the public.

If we take into consideration the geometric sizes and the distance of the microphones and the speaker on the headphone then reasonable assumptions can be made on the acoustic signal paths. With the help of these assumptions the computational complexity of the algorithm can be greatly reduced so it can be implemented without a processor which gives a possible explanation for the simplicity of some of the headphones.

One of the consequences of the reduced algorithm is that the secondary effects concerning the stability of the whole system modeled by the adaptive filter must be compensated in an alternative way. To do so one needs to identify the source of these effects and create models which can be realized with an analogue circuit.

The goal of this thesis is to propose a reduced active noise controlling system, and to examine the possibilites of modeling and realising the secondary path and to evaluate the measurements related to it. It discusses the applicability of the noise controlling method realized in continous time and it gives examples on the values of the parts thus demonstrating the realisability of the circuit.

Unfortunately one of the most important part of the system – the model of the secondary path – cannot be realised which prevented the construction of the device. This has theoretical and practical reasons because every LTI system should have a delayed inverse but it might be too complex to realise practically. The presented measurement results show that in the examined cases the delayed inverse was not stable which is why the device is not realisable.