Abstract

The area of multi-channel speech enhancement systems has already been developing more than 20 years. The majority of the effective algorithms invented during this period is specialised to suppress only spatially correlated or spatially uncorrelated type of noise. However, there is another type of noise which can be also observed in the field — the spatially diffuse noise arising from reverberations in closed areas. As the spatially diffuse noise comes under the most often occurring type of noise and there is no work focused on the multi-channel speech enhancement systems dealing with this type of noise, the presented work tries to fill up arisen gap and solves serious problems of the multi-channel speech enhancement systems related to suppressions of the spatially diffuse noise.

The first part of the work summarizes theoretical background of the multi-channel speech enhancement systems and brings the overview of the multi-channel algorithms used in the field. The features of the effective algorithms are compared in the next part. Considering the topic of the work, the dependence on the type of the input noise was the main criterion of the comparison. The linearly constrained beamformer with adaptive constraint values and the structure of coherence filter were chosen for the next work as the most promising algorithms. The modifiable structures of the algorithms and the capability to suppress appropriate types of input noise were the main reasons why these structures were selected. The algorithms were analysed and the modifications leading to the improvement of the suppression of the spatially diffuse noise were proposed. The impact of the modifications on speech distortion also was studied. The chosen results of the simulations realised to verify the characteristics of the modified algorithms are presented in the last part of the work. The results of the simulations support the theoretical assumptions and the noticeable improvements of diffuse noise reduction and signal distortion can be observed in the results.

This work was created as the thesis of the Ph.D. studies at the Department of Circuit Theory at the Faculty of Electrical Engineering of the Czech Technical University in Prague.