Improvement of Sound Quality in Vehicular Hands-Free Communication Systems

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ABSTRACT

For a vehicular hands-free communication system, the sound quality of communication is usually degraded by background noise such as engine noise and aerodynamic noise which are known to be detrimental to system performance. In this report, a novel adaptive filtering algorithm and an integrated system for acoustic echo and noise cancellation are presented. The proposed system includes adaptive noise cancellation, line enhancer, and echo cancellation which are based on a novel variable step-size affine-projection algorithm (VSS APA). The proposed VSS APA filtering algorithm is a combination of a variable step-size least-mean-square (VSS LMS) and an affine-projection algorithm (APA). The input signal in the APA is structured as a matrix, which is more complete than the vector structure in other algorithms. As a result, the estimation of the weight vector has orthogonality, thus allowing quick and accurate error corrections. However, the step-size of the APA is invariable. The choice of the step-size affects the overall performance of the algorithm. The variable step-size of the proposed VSS APA can adjust itself automatically to reach an optimum step-size according to the operations of the system at different times. To understand and verify the effectiveness of the proposed system, a performance evaluation and comparison were conducted to compare the proposed algorithm and various traditional adaptive filtering algorithms in this application. The results demonstrated that the VSS APA has an effective performance and convergence in sound quality improvement of hans-free communication systems.

Keywords : Echo cancellation， Adaptive filter; Hands-free communication system， Digital signal processor， VSS APA

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