基於特徵信號空間的強健式可適性干擾信號消除器之技術(II)

Techniques for Eigenspace-Based Adaptive Interference Cancellers with Robust Capabilities (II)

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主持人:李枝宏 國立臺灣大學電機系教授

研究生:李永定,賴正男,黃乾書,張世民.

一.中文摘要：本計劃已完成一項具有強健性的可適性干擾信號消除器之技術．基於適當地分割原陣列成為若干互相重疊之子陣列,首先計算每一子陣列的子空間後,再重建而得到原陣列的子空間．應用本有效的技術於可適性干擾信號消除,在使用一線性均勻之陣列.我們發展出一有效的技術使陣列干擾信號消除器能具有利用特徵信號空間(ESB)之優點且比傳統之ESB技術需要更少運算量及擁有更佳之信號接收能力．在信號源數目被高估時,我們發展出一有效的技術以加入假信號源的方法,來解決此問題.電腦模擬實驗結果展示本研究成果之有效性．

二.英文摘要：This project has finished the research work for eigenspace-based (ESB) adaptive interference cancelling with better capabilities. For adaptive interference cancellers using a ULA, we have proposed to prevent the response vector of the desired signal from lying in the estimated interference subspace by imposing artificial sources in the presence of steering angle error. The criteria required for determining the number, the powers, and the direction angles of the artificial sources have been presented. Modifications for enhancing the proposed technique has also been presented to alleviate the drawback of degrees of freedom loss by using the shift-invariant property of a ULA. It has been shown that the proposed technique makes the ESB interference canceller possess robust capabilities against steering angle errors. Computer simulations have demonstrated the effectiveness of the proposed technique.

Keywords: Adaptive Arrays, Interference Can-

celling, Eigenspace.

三.緣由與目的: Recently, the application of eigen-subspace concept has been considered to deal with adaptive interference cancelling under steering errors [1]-[4]. The so-called eigenspace-based (ESB) technique for interference cancelling usually requires the eigen-decomposition of the observation vector space into a subspace associated with the signal and a subspace associated only with the noise. The optimal weight vector lies in the signal subspace. Hence, only the signal subspace component is required for computing the optimal weight vector. In the case of incorrect steering, the optimal weight vector obtained based on the eigensubspace concept contains an undesired component falling on the noise subspace. The degradation in array performance is mainly caused by this undesired component. To cope with this problem, several conventional robust techniques have been presented in the literature [1-4]. However, there are major drawbacks in utilizing the above conventional ESB techniques for adaptive interference cancelling. One is that the performance suffers from severe degradation if there is mismatch between the presumed steering angle and the actual one. This is due to the fact that there is a leakage of the desired signal at the output of the blocking matrix and, hence, the estimated interference subspace (IS) will contain the direction vector of the desired signal. Therefore, it is worth developing an efficient technique to cure the problem of steering angle error for ESB interference cancellers.

四.研究方法與成果：研究方法:We present an artificial source injection (ASI) technique to eliminate the component of the response vector corresponding to the desired signal from the estimated IS. As a result, the proposed technique can avoid the desired signal can cancellation in the presence of steering angle error and overestimation of the interference number. Accordingly, the required criteria for choosing the appropriate number of artificial injection sources, the appropriate powers corresponding the artificial injection sources, and the appropriate direction angles of the artificial injection sources have been developed. Next, for dealing with the situations of coherent sources, we have further presented an approach based on the use of the shift-invariant property of a ULA to compensate the lost degrees of freedom to modify the proposed technique. 研究成果：We have accomplished the following research works: (1) the theoretical criterion for determining the required number of artificial injection sources. (2) the theoretical criterion for determining the required powers of the artificial injection sources. (3) the theo-

retical criterion for determining the required direction angles of the artificial injection sources. Moreover, the criterion for dealing with the loss in degrees of freedom due to using the spatial smoothing scheme in the situations of coherent sources has also been developed. Computer simulation results have confirmed and demonstrated the effectiveness of the proposed technique.

五.結論與討論：We have finished the proposed research works during the one-year research period. The proposed technique enhances the capabilities of an ESB interference canceller and makes an ESB interference canceller possess robust capabilities against steering angle errors. It is worth analyzing the robust capabilities provided by the proposed technique for further study.

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