Hybrid Adoption for Doppler Shift Mitigation in Aeronautical Communication

Tiby Verghis, Athira S Nair

Department of ECE, Mount Zion college of engineering, India

Abstract :

Doppler spectrum in an aeronautical channel is very important than we have to decrease the Doppler shift. Orthogonal frequency division multiplexing (OFDM)-based systems are sensitive to Doppler shifts/spread, since the time variation of the channel causes inter-carrier interference (ICI). ICI analysis is provided here for OFDM-based systems in the aeronautical channel. The effect of ICI on the received signal is presented and its power is derived. OFDM support large variety in which we have many scope. The Doppler estimation is done using many parameters and each can be made to its maximum efficiency. In this paper a hybrid technique is used as combining the minimum norm method with eigen values for Doppler estimation and for beamforming we are using singular decomposition method

I. INTRODUCTION

Orthogonal frequency division multiplexing (OFDM)-based schemes have been adopted for several current communication systems globally . In an OFDM-based system, a serial symbol stream is converted into a parallel stream and each symbol is modulated with different orthogonal subcarriers. Orthogonal subcarriers and cyclic prefix (CP) usage provide robustness to OFDM-based systems against the frequency selectivity of wireless channel. However, OFDM-based systems have relatively longer symbol durations compared with single-carrier systems. Longer symbol duration leads to weakness against the time variation of the channel, i.e., Doppler spread, which causes loss of orthogonality between the subcarriers.

II. MINIMUM NORM WITH EIGEN VALUES

Minimum norm method use single vector. It find the roots with minimum spikes and thus maximum efficiency can be achieved. In eigen value maximum roots has been calculated the values get add up each time and calculation is done.

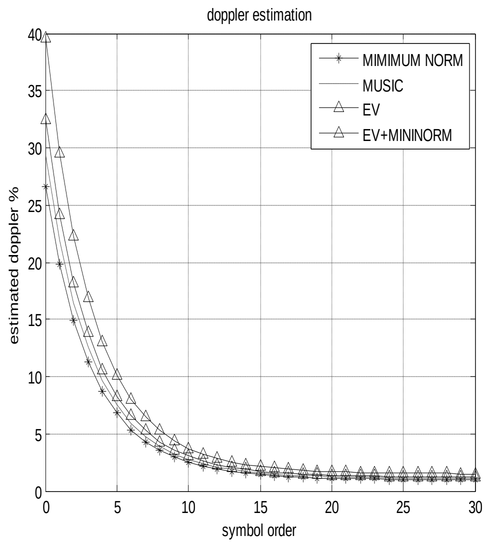


Figure 1

The figure 1 shows the simulation result of different methods. After the analysis of graph we can easily find that minimum norm with eigen value has the maximum Doppler estimation capacity.

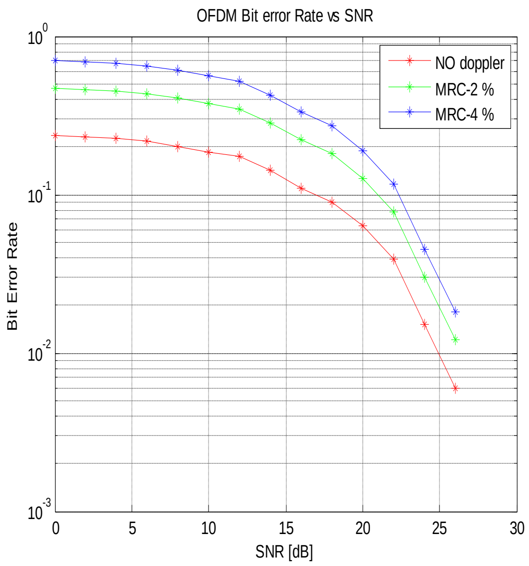
III. SINGULAR VALUE DECOMPOSITION

Suppose M is a $m \times n$ matrix whose entries come from the field K, which is either the field of real numbers or the field of complex numbers. Then there exists a factorization, called a singular value decomposition of M, of the form

M=UEV*

- U is a $m \times m$, unitary matrix,
- E is a $m \times n$ diagonal matrix with non-negative real numbers on the diagonal, and
- V* is a $n \times n$, unitary matrix over K. (If $K = \mathbb{R}$, unitary matrices are orthogonal matrices.) V* is the conjugate transpose of the $n \times n$ unitary matrix, V.

The diagonal entries, σ_i, of Σ are known as the singular values of M. A common convention is to list the singular values in descending order. In this case, the diagonal matrix,Σ, is uniquely determined by M (though not the matrices U and V). by this method beafroming can be done.



IV. CONCLUSION

In this paper an OFDM-based system is analyzed particularly for aeronautical environment and it is shown that ICI can be mitigated by exploiting the dual-Doppler shift characteristics of the aeronautical channel. As the number of paths is predictable, parametric spectrum estimation algorithms are used to estimate the Doppler shifts. Simulations using the MUSIC, EV, and minimum norm algorithms show that the estimation can be done efficiently with an MSE performance less than 1%. It is shown that increasing the autocorrelation matrix size, or number of OFDM symbols, for estimation, increases the MSE performance but can cause an increase in the number of computations, and the latency of the estimation, respectively. We show when modeling order is not correctly selected, the estimation performance degrades dramatically. For the compensation of ICI using the estimated Doppler shifts, we first find the DOAs of the paths. Based on DOA and estimation errors, we show that beamforming with a different number of antenna elements can create beams with resolutions that are capable of separating these Doppler affected paths. The separated signals are first compensated for single Doppler shift and then diversity combining techniques are used to improve the system BER performance.

REFERENCE

[1] Schnell, M. and Scalise, S. NEWSKY – Concept for NEtWorking the SKY for civil aeronautical communications. IEEE Aerospace and Electronic Systems Magazine, 22, 5 (May 2007), 5–29.

[2] Kerczewski, R. Aeronautical communications research and development needs for future air traffic management applications. In Proceedings of the IEEE Aerospace Conference, (AEROCONF) Mar. 2002, pp. 1169–1176.

[3] Sakhaee, E. and Jamalipour, A. The global in-flight internet. IEEE Journal on Selected Areas in Communication, 24 (Sept. 2006), 1748–1757.

[4] Lai, J. Broadband wireless communication systems provided by commercial airplanes. U.S. Patent 6 285 878, Sept. 4, 2001.

[5] Connell, L.Pilot and controller communications issues. In Proceedings of the Methods and Metrics of Voice Communications. Workshops, NASA-Ames Research Center, 1995.

[6] Jahn, A. and Holzbock, M. Evolution of aeronautical communications for personal and multimedia services. IEEE Communications Magazine (July 2003), 104–112