上鏈分碼多工系統中信號到達方向及時間延遲之估計

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摘 要

此論文將會提出一種有效率的演算法去共同估計訊號到達方向及時間延遲在非同步直序CDMA之多用戶的通訊系統。利用直序CDMA 模式之天線陣列的空間-時間特性,也就是多重信號分類（Multiple Signals Classification , MUSIC）演算法和信號旋轉不變(Estimation of Signal Parameters via Rotational Invariance Techniques , ESPRIT)之技術,它們已被廣泛的使用在陣列信號處理中去得到到達方向和時間延遲的資訊。多用戶之時間延遲之估計是根據MUSIC之演算法,而此時ESPRIT也正在估計每一用戶之DOA(Direction of arrival)。提出此演算法對於運算量是有效率的,它只需要兩次的EVD(eigenvalue decomposition)和幾次的一維空間尋找。更進一步的說, ESPRIT-MUSIC有抗遠近問題的能力,且不需要training sequences。因此,它是適合應用在上鏈之無線 DS/CDMA 通訊系統。

關鍵詞 : ESPRIT ; MUSIC ; 到達方向 ; 時間估計器 ; 抗近-遠效應

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參考文獻

[1] V. K. Grag , K. F. Smolik , J. E. Wilkes , “ Applications of CDMA in Wireless/Personal Communication ”, Prentice Hall.

[2] J. H. Winters, “ Smart Antenna for wireless systems ” IEEE Personal Communications, Vol.5, pp. 23-27, Feb 1998.

[3] B. Suard, A. F. Naguib, G. Xu and A. J. Paulraj, “ Performance of CDMA mobile communication system using antenna arrays ” pp. IV 153-156, ICASSP 1993.

[4] J. H. Winters, J. Salz, and R. D. Gitlin, “ The impact of antenna diversity on the capacity of wireless communication system ” IEEE Trans. Commun., Vol. 42, No.2/3/4, pp. 1740-1751, Feb./Mar./Apr. 1994.

[5] A. J. Paulraj and C. B. Papadias, “ Space-Time processing for wireless communications ” IEEE SP Magazine, pp. 49-83, Nov. 1997 [6] S. Y. Miller and S. C. Schartz, “ Integrated spatial-temporal detectors for asynchronous Gaussian multiple-access channels ” IEEE Trans. Commun., Vol. 43, No.2/3/4, pp. 396-411, Feb./Mar./Apr. 1995.

[7] R. Schmidt, “ Multiple emitter location and signal parameter estimation ” IEEE Trans. Ant. Propagation, Vol. AP-34:276-290, March 1986.

[8] E. G. Strom, S. Parkvall, S. L. Miller and B. E. Ottersten, “ Propagation delay estimation in asynchronous direct-sequence code division multiple access system ” IEEE Trans. Commun., Vol. 44 No. 1, pp. 84-93, Jan. 1996.

[9] S. E. Bensley and B. Aazhang, “ Subspace-based channel estimation for code division multiple access communication system ” IEEE Trans.

Commun., Vol. 44, No. 8, pp. 1009-1020, Aug. 1996.
[10]C. L. Chung, U. Mitra, “ Analysis of MUSIC-Based Delay Estimators for Direct-Sequence Code-Division Multiple-Access System ”, IEEE Trans.,Vol.47, No.1, pp. 133-138, Jan. 1999.
[11] M. C. Vanderveen, C. B. Papadias, and A. J. Paulraj, “ Joint angle and delay estimation for multipath signals arriving at an antenna array ”, IEEE Commun. Lett., vol.1, pp.12-14, Jan. 1997.
[12] R. Roy and T. Kailath, “ ESPRIT-Estimation of Signal Parameters via Rotational Invariance Techniques ”, IEEE Trans. ASSP, vol. 37, no. 7, pp.984-995, July 1989.
[13] A. J. Vanderveen, M. C. Vanderveen, and A.J. Paulraj, “ Joint angle and delay estimation using shift-invariance properties ”, IEEE Trans. Signal Processing, vol.46, pp.405-418, Feb. 1998.
[14] Y. Y. Wang, J. T. Chen, and W. H. Feng, “ TST-MUSIC for joint DOA-Delay estimation ”, IEEE Trans. Signal Processing, vol.49, no. 4, pp.721-729, Apr. 2001.
[15] R. L. Peterson, R. E. Ziemer, D. E. Borth, “ Introduction To Spread-Spectrum Communications ”, Prentice Hall.
[16] S. Hakin, “ Communication systems ” Wiley, 1994.
[17] S. Glisic, B Vucetic, “ Spread Spectrum CDMA Systems Wireless Communications ” Artech House,1997 [18] L. Harte, M. Hoenig, D. Mclauaghlin, R. K. Kta, “ CDMA IS-95 for Cellular and PCS—Technology, Economics and Services ”,McGraw-Hill,1999 [19] L. Hui, “ Signal Processing Applications in CDMA Communications ”, Artech House, 2000.
[20] J. C. Liberti, Jr., T. S. Rappaport, “ Smart Antenna for Wireless Communications:IS-95 and Third Generation CDMA Applications ”, Prentice Hall PTR [21] A. Flieller, P. Larzabal, H. Clergeot, “ Applications of High Resolution Array Processing Techniques for Mobile Communication System ”, Prof. Intel. Vehic. '94 Sym. pp. 606-611,October 1994.
[22] N. Odachi, H. Shoki, and Y. Suzuki, “ High-speed DOA Estimation using Beamspace MUSIC ”, VTC 2000-spring Tokyo, Vol.2, pp.1050-1054, May. 2000.
[23] A. Margarita, S.J. Flores, L. Rubio, V. Almenar and J.L. Corral, “ Application of MUSIC for Spatial Reference Beamforming for SDMA in a smart Antenna for GSM and DECT ”, VTC 2001-spring, Vol.1, pp.6-9, May. 2001.
[24] Y. H. Choi “ Alternating minimization approach to generalized MUSIC and its performance ” IEE Proc.-Radar Sonar Navig, Vol. 149, No.2, April. 2002.
[25] R. Roy, A. Paulraj, and T. Kailath, “ A subspace Rotation Approach to Estimation of Parameters of Cisoids in Noise ”, IEEE Trans. Signal Processing, Vol.34, pp.1340-1342, Oct. 1986.
[26] S. Haykin, “ Advances in Spectrum Analysis and Array Processing ”, Prentice Hall PTR, 1995.
[27] J. M. Mendle, Lessons in Estimation Theory for Signal Processing, Communications, and Control, Lesson 11, Englewood Cliffs, NJ: Prentice Hall, 1995.
[28] I. Ziskind and M. Wax, “ Maximum Likelihood Localization of Multiple Sources by Alternating Projection ”, IEEE Trans. on Acoustics, Speech, and Signal Processing, Vol.36, No.10, pp. 1553-1560, Oct. 1988.
[29] E. G. Strom, S. Parkvall, S. L. Miller, B. E. Ottersten, “ Propagation Delay Estimation of DS-CDMA Signals in a Fading Environment ”, IEEE Globecom, pp.85-89, Dec. 1994.
[30] Z. Ruifeng, T. Zhenhui, “ ESPRIT-Based Delay Estimators for DS-CDMA Systems ” IEEE, ICC., Vol.3, pp.1472-1476, June. 2000.