

A Second Order log-MAP Algorithm for Turbo Code Decoding in CDMA Communications under Fading

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ABSTRACT

A novel log-MAP algorithm with second order approximation for turbo code decoding in CDMA communications under fading is presented. Simulation results are performed for the IS-2000 CDMA turbo code under Additive White Gaussian Noise (AWGN) and slow fading channels by using various log-MAP algorithms. Results reveal that bit-error-rate (BER) performance of proposed second order log-MAP algorithm is superior to those of previous log-MAP algorithms such as max-log-MAP, constant-log-MAP, and linear-log-MAP.

Keywords : Code Division Multiple Access ; Turbo Decoding

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REFERENCES

- [1] C. Berrou, A. Glavieuc and P. Thitimajshima, "Near Shannon Limit Error-Correcting Coding and Decoding: Turbo Codes", Proc., 1993, Int. Conf. Com., May 1993, Geneva, Switzerland, pp. 1064-1070.
- [2] P. Robertson, P. Hoeher and E. Villebrun, "Optimal and Sub-Optimal Maximum A Posteriori Algorithms Suitable for Turbo Decoding", European Trans. On Telecommun., Mar./Apr. 1997, Vol. 8, pp. 119-125.
- [3] S. Benedetto, D. Divsalar, G. Montorsi and F. Pollara, "A Soft-Input Soft-Output Maximum A Posteriori (MAP) Module to Decode Parallel and Serial Concatenated Codes", TDA progress report 42-127, Nov. 15, 1996.
- [4] W. J. Gross and P. G. Gulak, "Simplified MAP Algorithm Suitable for Implementation of Turbo Decoders", Electronics Letters, Aug. 1998, Vol. 34, pp. 1577-1578.
- [5] B. Classon, K. Blankenship and V. Desai, "Turbo Decoding with The Constant-Log-MAP Algorithm", Proc., Second Int. Sym. Turbo Codes and Related Appl., Sep. 2000, Brest, France, pp. 467-470.
- [6] M. C. Valenti and J. Sun, "The UMTS Turbo Code and An Efficient Decoder Implementation Suitable for Software-Defined Radios", Int. J. Wireless Information Networks, Oct. 2001, Vol. 8, pp. 203-215.
- [7] 翁萬德、江松茶, "通訊系統", 第四版, 全華科技圖書股份有限公司, 1993年。
- [8] R. G. Gallager, "Low-Density Parity-Check Codes", IEEE Trans. Inform. Theory, IT:8:21-28, Jan. 1963.

- [9] 林振華, “ MATLAB/Simulink在CDMA上的應用 ”, 全華科技圖書股份有限公司, 2001年。
- [10] K. Wang, J. Xu, J. Tang, Z. Zhang and C. Zhang, “ Modified Turbo Code Decoding Algorithm in CDMA Communications Under Fading Channel ”, Proc., 2005, Int. Conf. Communications, Circuits and Systems, May 2005, Hong Kong, China, Vol. 1, pp. 27-30.
- [11] L. R. Bahl, J. Cocke, F. Jelinek, and J. Raviv, “ Optimal Decoding of Linear Codes for Minimizing Symbol Error Rate, ” IEEE Trans. Inform. Theory, Vol. 20, pp.284-287, Mar. 1974.
- [12] J. A. Erfanian, S. Pasupathy and G. Gulak, “ Reduced Complexity Symbol Detectors with Parallel Structures for ISI Channels ”, IEEE Trans. Commun., Feb./Mar./Apr. 1994, Vol. 42, pp. 1661-1671.