Comparison and Investigation with LCR and AFD Methods to Estimate the Selection Combining Working in Generalized Fading

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ABSTRACT

In this paper the performance evaluation with the average LCR (level crossing rate) and AFD (average fading duration) criterion are applied to analyze the SC (selection combining) diversity. The fading channel models are characterized as Rayleigh and Rician distributed statistics. Both of the independent of branches and the correlation proprieties between branches are considered in this investigation. In order to compare the performance results between the different fading channels for SC with average LCR and AFD performance, it is not only the results from our study presented, but the propagation fading channels are with dual-branch Nakagami-m and Weibull statistics that have been presented are also shown in this study.

Keywords: Rayleigh; Rician; Nakagami-m; Weibull Fading Channel; SC Diversity; LCR; AFD

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REFERENCES

參考文獻 [1] W.C. Jakes, "Microwave Mobile Communication." New York, NY: IEEE Press, 1993.

- [2] G..L Stiiber, "Principles of Mobile Communication." Boston, MA: Kluwer, 1996.
- [3] M. Patzold and F. Laue, "Level-Crossing Rate and Average Duration of Fades of Deterministic Simulation Models for Rice Fading Channels, "IEEE Trans. Veh. Technol., Vol. 48, No. 4, pp. 1121-1129, July 1999.
- [4] F. Adachi, M. T. Feeney and J. D. Parsons, "Level Crossing Rate and Average Fade Duration for Time Diversity Reception in Rayleigh Fading Conditions," IEEE Proc., Vol. 135, Pt. F, No. 6, Dec. 1988.
- [5] L. Yang and M. S. Alouini, "An Exact Analysis of the Impact of Fading Correlation on the Level Crossing Rate and Average Outage Duration of Selection Combining," IEEE Trans. Veh. Technol., Vol. 1, pp. 241-245, Apr. 2003.
- [6] X. Dong and N. C. Beaulieu, "Level Crossing Rate and Average Fade Duration of Selection Diversity," IEEE Commun. Lett., Vol. 5, pp.396-398, Oct. 2001.
- [7] T. T. Tjhung and C. C. Chai, "Fade Statistics in Nakagami- Lognormal Channels," IEEE Trans. Commun., Vol. 47, No. 12, pp. 1769-1772, Dec. 1999.
- [8] N. C. Sagias and G. K. Karagiannidis, "Performance of Dual Selection Diversity in Correlated Weibull Fading Channels," IEEE Tran. on Commun., Vol.52, No.7, pp. 1063-1067, July 2004.
- [9] Joy Iong-Zong Chen, "Evaluation for Average LCR and AFD of Dual MRC and SC Diversity over Correlated Nakagami Environments,"

Wireless Personal Communications, to be published, 2005.

- [10] Matthias Patzold, "Mobile Fading Channel." Wiley, pp.3-7, 2002.
- [11] B. Sklar, "Digital Communications: Fundamental and Applications." Prentice-Hall PTR, New Jersey, 1988.
- [12] K. Feher, "Wireless Digital Communications: Modulation and Spread Spectrum Applications." Prentice Hall PTR, New Jersey, 1995.
- [13] T. S. Rappaport, "Wireless Communications Principles and Practice." Prentice Hall PTR, New Jersey, 1996.
- [14] S. Bernard "Digital Communications Fundamentals and Applications", pp. 962-966, Prentice Hall International, Inc, 2001.
- [15] B. Sklar, "Rayleigh Fading Channels in Mobile Digital Communication Systems Part 1: Characterization," IEEE Commun. Magazine, pp. 90-100, July 1997.
- [16] J. G. Proakis, "Digital Communications." 3rd ed., McGraw-Hill, New York, 1995.
- [17] Yacoub, M. D., "Foundations of Mobile Radio Engineering", CRC Press Inc, 1993.
- [18] Mondre, E., "Complex and Envelope Covariance for Rician Fading Communication Channels Communications", IEEE Trans. [legacy, pre 1988], Vol. 19, Issue: 1, pp. 80-84, Feb. 1971.
- [19] D. Middle, "An Introduction to Statistical Communication Systems and Techniques", New York: McGraw-Hill, 1966.
- [20] Suzuki, H., "A Statistical Model for Urban Radio Propagation", IEEE trans. Commun., Vol. 27, No. 4, pp. 657-670, Apr. 1979.
- [21] Nakagami, M., "The m-distribution A Formula of Intensity Distribution of Rapid Fading in Statistical Methods in Radio Wave Propagation," W. G. Hoffman Ed.,Oxford, England: Pergamon Press, 1960.
- [22] I. S. Gradshteyn and I. M. Ryzhik, "Table of Integrals, Series, and Products, 5th ed." New York: Academic, 1994.
- [23] M. K. Simon and M.-S. Alouini, "Digital Communications over Generalized Fading Channels: A Unified Approach to Performance Analysis." Wiley, New York, 2000.
- [24] C. C. Tan and N. C. Beaulieu, "Infinite Series Representation of the Bivariate Rayleigh and Nakagami-m Distributions," IEEE Trans. on Commun, Vol. 45, pp.1159-1161, Oct. 1997.
- [25] K. Bury, "Statistical Distribution in Engineering", Cambridge, U.K:Cambridge Univ.Press, 1999.
- [26] P. J. Crepeau, "Uncoded and Coded Performance of MFSK and DPSK in Nakagami Fading Channels," IEEE Trans. on Commun., Vol. 40, No.3, pp. 487-493, Mar. 1992.
- [27] J. C. Lu and G., K. Bhattaacharyya, "Some New Constructions of Bivariate Weibull Models," Ann. Inst. Stat. Math, Vol. 42, No.3, pp. 543-559, 1990.
- [28] S. Kotz, N. Balakrishnan and N. L. Johnson, "Continuous Multivariate Distributions." Vol. 1:Model and Applications. New York:Wiley, 2000
- [29] A. Papoulis, "Probability, Random Variables, and Stochastic Processes, 3rd ed." New York: Mcgraw-Hill, 1991.
- [30] Lee, W. C. Y., "Statistical Analysis of the Level Crossing Rate and Duration of Fades of the Signal from an Energy Density Mobile Radio Antenna," Bell System Technical Journal, Vol. 46, pp. 418, Feb. 1967.
- [31] Lee, W. C. Y., "Mobile Communications Engineering-Theory and Applications, 2nd ED," McGraw-Hill, 1998.
- [32] A. Abdi, H. Allen Barger and M. Kaveh, "A Parametric Model for the Distribution of the Angle of Arrival and the Associated Correlation Function and Power Spectrum at the Mobile Station," Submitted to IEEE Trans. Veh. Tech., Sep. 1999.
- [33] W. C. Jakes. Jr., "Multipath Interference in Microwave Mobile Communications," W. C. Jakes. Jr., Ed., New York: Wiley, pp. 17-78, 1974.
- [34] M. Patzold, U. Killat and F. Laue, "An Extended Suzuki Model for Land Mobile Satellite Channels and Its Statistical Properties," IEEE Trans, Veh. Tech., Vol. 47, pp. 617-630, 1998.
- [35] N. Youssef, T. Munakata and M. Takede, "Fade Statistics in Nakagami Fading Environments," IEEE Int. Symp, Spread Spectrum Tech. Application, Mainz, Germany, pp. 1244-1247, 1996.
- [36] Bodtmann W.F and Arnold H.W, "Fade Duration Statistics of a Rayleigh-Distributed Wave." IEEE trans. on Commun, Vol. 30, pp. 54-549, 1982.
- [37] Nikos C. Sagias, Dimitris A. Zogas, George K. Karagiannidias and George S. Tombras, "Channel Capacity and Second-Order Statistics in Weibull Fading," IEEE Commun. Lett., Vol. 8, No. 6, pp. 377-379, June 2004.
- [38] Peterson. R. L., Ziemer, R. E., and Borth, D. E., "Introduction to Spread Spectrum Communications," New York: McGraw-Hill, 1995.
- [39] Brennan D. G., "Linear Diversity Combining Technique." Proceeding of the IRE, Vol. 47, pp. 1075-1102, June 1959.
- [40] Adachi, F., et al., "Effects of Correlated Fading on Level Crossing Rates and Average Fade Durations with Predetection Diversity Reception." IEE Proc. 135 (1), pp. 11-17, Feb. 1988.
- [41] Q. T. Zhang and H. G. Lu, "A General Analytical Approach to Multi-Branch Selection Combining over Various Spatially Correlated Fading Channels," IEEE Trans. on Commun., Vol. COM- 50, pp. 1066-1073, July 2002.
- [42] W. C. Y. Lee, "Level Crossing Rates of an Equal-Gain Predetection Diversity Combining," IEEE Trans. on Commun., Vol. COM-18, No. 4, pp. 417-425, 1970.
- [43] Y. Chen, and C. Tellambura, "Performance of L-Branch Diversity Combiners in Equally Correlated Rician Fading Channels", IEEE Global Telecommunications Conference, Vol. 5, pp. 3379-3383, Dec. 2004.

- [44] Y. Chen, and C. Tellambura, "Distribution Functions of Selection Combiner Output in Equally Correlated Rayleigh, Rician, and Nakagami-m Fading Channels", IEEE Trans., Vol. 53, pp. 1948-1956, Nov. 2004.
- [45] A. A. Abu-Dayya, and N. B. Beaulieu, "Microdivisity on Rician Fading Channels", IEEE Trans. on Commun., Vol. 42, pp. 2258-2267, 1994.
- [46] S. W. Halpern, "The Effect of Having Unequal Branch Gains in Practical Predetection Diversity System for Mobile Radio", Vol. VT-26, No. 1, pp. 94-105, 1977.