A Class of Selection Criteria Achieving Full Diversity in AF Opportunistic Relaying

Xu Chen^{*†}, Ting-wai Siu[†], Qing F. Zhou^{‡†} and Francis C. M. Lau[†] *Department of Electronic Engineering and Computer Science, Northwestern University, Evanston, IL, USA

[†]Department of Electronic and Information Engineering, The Hong Kong Polytechnic University, Hong Kong

[‡]Department of Electronic Engineering, City University of Hong Kong, Hong Kong Email: chenx@u.northwestern.edu,dtwsiu@gmail.com, enzhouqingfeng@gmail.com, encmlau@polyu.edu.hk

Abstract

The way to select the "best" relay for forwarding the received signal to the destination is critical in opportunistic relaying. In this paper, we analyze the asymptotic outage probability of the amplify-and-forward opportunistic relaying (AF-OR) under a generalized selection criterion termed as the max-generalized-mean (MGM) selection criterion. We show that this generalized selection framework can be regarded as a class of selection criteria achieving full diversity in the AF-OR, encompassing the conventional selection criteria as special cases. The asymptotic outage probability can be further minimized by optimizing the parameters associated with the MGM selection criterion. It is shown that under this generalized selection framework, the conventional max-min selection criterion is optimal for the AF-OR in the sense that it achieves the minimum outage probability.

Index Terms

Outage Probability, opportunistic relaying, selective decode-and-forward, harmonic mean



Francis C.M. Lau received the BEng (Hons) degree in electrical and electronic engineering and the PhD degree from King's College London, University of London, UK, in 1989 and 1993, respectively.

He is a Professor and Associate Head at the Department of Electronic and Information Engineering, The Hong Kong Polytechnic University, Hong Kong. He is also a Fellow of IET and a senior member of IEEE. He is the co-author of *Chaos-Based Digital Communication Systems* (Heidelberg: Springer-Verlag, 2003) and *Digital Communications with Chaos: Multiple Access Techniques and Performance Evaluation* (Oxford: Elsevier, 2007). He is also a co-holder of three US patents and one pending US patent. He has published over 230 papers. His main research interests include channel coding, cooperative networks, wireless sensor networks, chaos-based digital communications, applications of complex-network theories, and wireless communications.

He served as an associate editor for *IEEE Transactions on Circuits and Systems II* in 2004–2005 and *IEEE Transactions on Circuits and Systems I* in 2006–2007. He was also an associate editor of *Dynamics of Continuous, Discrete and Impulsive Systems, Series B* from 2004 to 2007, a co-guest editor of *Circuits, Systems and Signal Processing* for the special issue "Applications of Chaos in Communications" in 2005, and an associate editor for IEICE Transactions (Special Section on Recent Progress in Nonlinear Theory and Its Applications) in 2011. He has been a guest associate editor of *International Journal and Bifurcation and Chaos* since 2010 and an associate editor of *IEEE Circuits and Systems Magazine* since 2012.