Outage Performance Analysis of IHDAF Cooperative based Communication System

Jianghao Li[1], Zhiquan Bai[1*], Haixia Zhang[1], Yingchao Yang[1], Shangqian Sun[2], Tao Han[3] and Kyungsup Kwak[4]

[1]*School of Information Science and Engineering, Shandong University, Jinan, China*

[2]*School of Physics, Shandong University, Jinan, China*

[3]*School of Electronic Information and Communications, Huazhong University of Science and Technology, Wuhan, China*

[4]*Graduate School of Information Technology and Telecommunications, INHA University, Incheon, Korea*

Email: zqbai@sdu.edu.cn*

***Abstract*—In this paper, we propose an incremental hybrid decode-amplify-forward (IHDAF) cooperative scheme based free space optical (FSO) communication system to resist the performance degradation caused by path loss, atmospheric turbulence, and pointing errors. The IHDAF cooperative FSO system can choose direct transmission, decode-and-forward (DF) and amplify-and-forward (AF) relaying protocols flexibly according to the instantaneous channel state information (CSI) and signal-to-noise ratio (SNR). The outage probability analysis of the IHDAF cooperative FSO system is also presented in the weak turbulence channel with pointing errors. Numerical results show that the proposed IHDAF cooperative FSO system improves the system performance compared with the other conventional cooperative FSO systems. Moreover, we also study the effects of the power allocation and the relay position on the system performance of the proposed IHDAF cooperative FSO system.**

***Keywords—IHDAF*; *free space optical*; *atmospheric turbulence*; *pointing errors; outage probability.* For a list of suggested keywords, send a blank e-mail to keywords@ieee.org or visit** http://www.ieee.org/organizations/pubs/ani_prod/keywrd98.txt

Jianghao Li received the B.Sci. degree from the School of Science and Engineering in Lanzhou University in 2015. He is pursuing Master degree at the school of Information Science and Engineering in Shandong University. His main research interests are in the areas of optical wireless communication and cooperative communication.

Zhiquan Bai received his BS degree from Inner Mongolia University, Huhehot, China, in 2000, MS degree from Shandong University, Jinan, China, in 2003, and PhD degree with honor from INHA University under the Grant of Korean Government IT Scholarship, Korea, in 2007. From 2007 to 2008, he was a post-doctor in UWB Wireless Communications Research Center, INHA University, Korea. After that, he has been an associate professor in the School of Information Science and Engineering, Shandong University, China. He has been the visiting scholar in University of British Columbia (UBC) from 2015 to 2016. He is an associate editor of the International Journal of Communication Systems and also a member of the IEEE. His current research fields include cooperative communication, MIMO system and spatial modulation, Optical Wireless Communication, cognitive radio, ultra wideband technologies and advanced channel coding and modulation.

Haixia Zhang received her MS degree and Ph.D from Shandong University, Jinan, China, in 2004 and 2008. From 2006 to 2008, she was with the Institute for Circuit and Signal Processing, Munich University of Technology as an Academic Assistant. Since 2009, she joined School of Information Science and Engineering at Shandong University as an associate professor. From 2011, she was appointed full professor at Shandong University, where she teaches courses on Signal Processing, MIMO Systems, Stochastic Processes, and Principle of Communications in the field of Wireless Communications and Signal Processing applications.

Yingchao Yang received his master degree in computer technology from Shandong University of Science and Technology in 2 015, he is pursuing PhD degree at the School of Information Science and Engineering in Shandong University. His main resear -ch interests are in the areas of Spatial Modulation and Cooperative Communications.

Shangqian Sun received his master degree from the school of physics in Shandong University in 2004 and PhD degree from Institute of Crystal Materials in Shandong University in 2014. Now he is a teacher at the school of physics in Shandong University. His current research interests are crystal spectroscopy including Raman, IR, absorption and fluorescence etc.

Tao Han received his B.Eng. degree, master degree and Ph.D from Huazhong University of Science and Technology in 1990, 1993 and 2001, respectively. He has been the visiting scholar in University of Florida from 2015 to 2016. His current research fields include mobile communication, Multi-Media Communication, Optical Fiber Communication, and Computer Network.

Kyung Sup Kwak received his BS degree from the Inha University, Inchon, Korea, in 1977 and his MS degree from the University of Southern California in 1981 and his PhD degree from the University of California at San Diego in 1988, under the Inha University Fellowship and the Korea Electric Association Abroad Scholarship Grants, respectively. From 1988 to 1989, he was with Hughes Network Systems, San Diego, California. From 1989 to 1990, he was with the IBM Network Analysis Center, North Carolina. Since then, he has been with the School of Information and Communication Engineering, Inha University, Korea, as a professor. He is the director of UWB Wireless Communications Research Center (UWB-ITRC). Since 1994, he served as a member of the board of directors and the vice president and the president of Korean Institute of Communication Sciences (KICS) in 2006 and the president of Korea Institute of Intelligent Transport Systems (KITS) in 2009. He received many research awards, such as the award of research achievements in UWB radio from the Ministry of Information & Communication and Prime Ministry of Korea in 2005 and 2006, respectively. In 2008, he is elected as Inha Fellow Professor (IFP). In 2010, he received the Korean President official commendation for his contribution to ICT innovation and industrial promotion. He published more than 100 SCI journal papers, 300 conference/domestic papers, obtained 20 registered patents and 35 pending patents, and proposed 21 technical proposals on IEEE 802.15 (WPAN) PHY/MAC. He is one of the members of the IEEE, IEICE, KICS, and KIEE. His research interests include multiple access communication systems, cognitive radio, UWB radio systems and WBAN, WPAN, and sensor networks.