Cooperative MIMO Applied Null Beamforming to Self in Full-Duplex Wireless Communication System and Its Implementation

Masahiro Kawano*, Yuhei Nagao*, Leonardo Lanante Jr*, Masayuki Kurosaki* and Hiroshi Ochi*

*Graduate School of Computer Science and Systems Engineering, Kyushu Institute of Technology, JAPAN
kawano.ma, nagao@dsp.cse.kyutech.ac.jp, leonardo, kurosaki, ochi@cse.kyutech.ac.jp

Abstract—This paper proposes a full-duplex wireless communication system applying cooperative multiple-input multiple-output (Co-MIMO). This proposal solves self-interference (SI) in full-duplex wireless communication systems by applying the block diagonalization used in multi-user MIMO (MU-MIMO). Therefore, there is no need for a radio frequency (RF) canceller, which has a large hardware size and is difficult to extend to MIMO. Furthermore, higher throughput can be achieved by applying Co-MIMO, in which multiple access points work together to communicate. We also introduce the implementation of the proposed method using a field-programmable gate array (FPGA) and software-defined radio (SDR) in this paper. It shows that SI cancellation can be realized by using them. The proposed method is implemented based on the IEEE 802.11n frame format as an example. In the experiment, a total of 30 [dB] SI cancellation is confirmed with a transmission power of -12 [dBm]. The SI cancellation amount can be further increased by increasing the transmission power.

Keyword—Cooperative MIMO, Full-Duplex Wireless Communication, Self-Interference Cancellation

Mr. Masahiro Kawano received the B.S. (2019) from Kyushu Institute of Technology, Japan. He is currently a M.S. student at Kyushu Institute of Technology. His research interest is full-duplex wireless communication.

Dr. Yuhei Nagao received the B.S., M.S. and Ph.D. degrees in Information Systems from Kyushu Institute of Technology in 2002, 2006 and 2009, respectively. Since 2009, he has been a researcher in Kyushu Institute of Technology. His research interests include wireless communication and VLSI chip design. He is a member of the IEEE.

Dr. Leonardo Lanante Jr received the B.S. in Electronics and Communications Engineering degree and M.S. in Electrical Engineering from University of the Philippines, and Ph.D. in Information Systems from Kyushu Inst. of Technology in 2005, 2007, and 2011 respectively. He is currently with the Kyusha Institute of Technology as an assistant professor in Computer Science and Systems Engineering department since 2014. His research interests include next generation WLAN technology including multiple access, MIMO-OFDM, and localization. He is a member of the IEEE.

Prof. Masayuki Kurosaki received B.E. (2000), M.E. (2002) and Ph.D. (2005) from Tokyo Metropolitan University. He was with Kyushu Institute of Technology (KIT) from 2005 to 2011 as an Assistant Professor. Since 2011, he has been with Kyushu Institute of Technology (KIT) as an Associate Professor. His research interests are image processing and wireless communication for multimedia. He is a member of the IEEE.

Prof. Hiroshi Ochi received the B.S. and M.S. degree in electronics engineering from Nagaoka Institute of Technology, Japan in 1981 and 1984, respectively. He also received Ph.D. degree in electrical engineering from Tokyo Metropolitan University in 1991. He also receives MBA degree from Kyushu University in 2007. He is currently with Kyushu Institute of Technology as a professor in computer and electronics engineering department since 1999. His current research interests include signal processing for wireless communication system, VLSI chip design and MOT education. He is also a CEO of a venture company Radrix co.ltd. He is a member of the IEEE.