Correction to "Two-Way AF Relaying in the Presence of Co-Channel Interference"

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***Index Terms*—Amplify-and-forward, interference limited systems, outage probability, two-way relaying.**

TWO closed-form expressions for the end-to-end cumulative distribution function (CDF) and outage probability of two-way interference-limited amplify-and-forward (AF) relaying were presented recently in [1, Eq. (19)] and [1, Eq. (24)], respectively. However, the expressions contain a notational error. They are approximations to the exact CDF and outage probability expressions (instead of bounds). In particular, the correct expression for the CDF of the upper-bounded end-to-end signal to interference-plus-noise ratio (SINR), $\gamma_{\mathrm{e2e}}^{\mathrm{up}}$, should be expressed as

$$F_{\gamma_{\mathrm{e2e}}^{\mathrm{up}}}(z) \approx 1 - \Big(\mathcal{P}_{11}(z) + \mathcal{P}_{12}(z)\Big)\Big(\mathcal{P}_{21}(z) + \mathcal{P}_{22}(z)\Big) \quad (1)$$

where the equality sign is replaced by the approximate sign in [1, Eq. (19)]. By using (1), we can now obtain the following approximation of the exact outage probability of the system

$$P_{\mathrm{out}}(\gamma_{\mathrm{th}}) \geq P_{\mathrm{out}}^{\mathrm{lb}}(\gamma_{\mathrm{th}}) \approx 1 - \mathcal{P}_1(\gamma_0)\mathcal{P}_2(\gamma_0) \quad (2)$$

where the equality sign is replaced by the approximate sign in [1, Eq. (24)].

The above mentioned notational inconsistencies reside in the proofs of Proposition 2 and 3. More specifically, the problem in both cases stems from a wrong assumption of independence between two dependent random variables. For instance, in Appendix II, the variables r and w are mistakenly taken as independent. Since this assumption does not hold, we cannot use the property $\mathbb{E}(a * b) = \mathbb{E}(a) * \mathbb{E}(b)$ (where $\mathbb{E}(.)$ denotes expectation) with equality but only as an approximation. Interestingly, our numerical results demonstrate that the error induced by this approximation is marginal in all cases under consideration. We point out that, in the proof of Proposition 2 (i.e., Appendix II), we should only remove the second expression in [1, Eq. (72)], whilst the expressions in [1, Eqs. (73, 74)] remain correct. Also, in the proof of Proposition 3 (i.e., Appendix III), the equality signs in the last expression in [1, Eq. (75)] and in [1, Eqs. (76–79)] should be replaced by the approximate signs.

Therefore, [1, Eq. (19)] is an approximate expression to the CDF of the end-to-end SINR and, likewise, [1, Eq. (24)] is an approximate expression to the end-to-end outage probability of two-way interference-limited AF relaying systems.

Note that similar corrections apply for the conference version of [1], that is [2].

I. Acknowledgement

The authors wish to thank Dr. Caijun Zhong, Zhejiang University, China for providing the above useful suggestions and corrections.

References

[1] E. Soleimani-Nasab, M. Matthaiou, M. Ardebilipour, and G. K. Karagiannidis, "Two-way AF relaying in the presence of cochannel interference," *IEEE Trans. Commun.*, vol. 61, no. 8, pp. 3156-3169, Aug. 2013.

[2] E. Soleimani-Nasab, M. Matthaiou, G. K. Karagiannidis, and M. Ardebilipour, "Two-way interference-limited AF relaying over Nakagami-m fading channels," in *Proc. 2013 IEEE Global Commun. Conf.*, pp. 4380–4386.

Manuscript received January 27, 2014; no revision. The editor coordinating the review of this paper and approving it for publication was Y. Chen.

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Digital Object Identifier 10.1109/TCOMM.2014.020814.140081