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Comments on and Corrections to “SVD-Precoded Faster-Than-Nyquist Signaling With Optimal and Truncated Power Allocation”

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Abstract—This correspondence corrects the limitations of a system parameter in “SVD-Precoded Faster-Than-Nyquist Signaling With Optimal and Truncated Power Allocation” in *IEEE Transactions on Wireless Communications*, vol. 18, no. 12, Dec. 2019. We do not present any novelty in these errata.

I. OPTIMAL POWER ALLOCATION

In [1], the capacity formulas [1, eqs. (53)–(55)] are derived without explicitly limiting the range of the symbol packing ratio τ , and this is incorrect.

More specifically, in [1, Sect. 3], the optimal power allocation factors [1, eq. (50)] of singular value decomposition (SVD) precoded faster-than-Nyquist (FTN) signaling are derived by maximizing the achievable information rate [1, eq. (32)]. In this derivation, it is assumed that all the eigenvalues λ_i ($i = 0, \dots, N - 1$) of the FTN-induced intersymbol-interference (ISI) matrix \mathbf{G} are positive.¹ Since the optimal power allocation factors p_i ($i = 0, \dots, N - 1$) are the inverses of the eigenvalues, i.e., $p_i = 1/\lambda_i$ in [1, eq. (50)], having non-zero eigenvalues is a necessary condition.

However, this assumption holds for the case of a finite block length with an unlimited τ range, or for the case of an unlimited block length with the range

$$\tau \geq \frac{1}{1 + \beta}, \quad (1)$$

as proved in [2], where β is a roll-off factor of a root-raised cosine filter employed. Note that for $\tau < 1/(1 + \beta)$, some of the eigenvalues approach zero upon increasing the block length N . As a result, the capacity formulas [1, eqs. (53)–(55)] of SVD-precoded FTN signaling with optimal power allocation, which are derived in the limit of $N \rightarrow \infty$, hold only for the range (1).

Additionally, [1, eqs. (56)–(58)] show the capacities of the SVD-precoded FTN signaling with optimal power allocation in the limit of $\tau \rightarrow 0$. However, capacity is typically defined under the assumption of an infinite block length, i.e., $N \rightarrow \infty$, and as mentioned above, (1) has to be satisfied in the presented scheme with optimal power allocation when $N \rightarrow \infty$. Hence, [1, eqs. (56)–(58)] are the incorrect bounds, which are unachievable.

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¹SVD of \mathbf{G} conducted in [1] is equivalent to eigenvalue decomposition of \mathbf{G} . Hence, in this correspondence, we refer to eigenvalues of \mathbf{G} instead of singular values of \mathbf{G} .

Note that the above-mentioned discussions as well as the fundamental benefits of FTN signaling are provided in [3]–[5].

II. TRUNCATED POWER ALLOCATION

In [1, Sect. 4], to avoid the extremely low eigenvalues induced when $\tau < 1/(1 + \beta)$, truncated power allocation is introduced for a finite block length. As mentioned in [1], the effects of inter-block interference (IBI) are ignored throughout the paper. Naturally, when taking into account the effects of IBI, the information rates [1, eqs. (62), (63)] of the SVD-precoded FTN signaling scheme with truncated power allocation are reduced to those lower than the Shannon limit.

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