Title
Correction to “Multicast Networks with Variable-Length Limited Feedback”

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Correction to “Multicast Networks with Variable-Length Limited Feedback”
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Abstract

This report corrects an error in the proof of Lemma 4 in [1].

The statement of Lemma 4 in Appendix D of [1] is correct; however, its proof in Appendix F has flaws. In its corrected form, the proof is presented as follows.

\textbf{Lemma 4:} For complex unit-norm vectors $u, v, w \in \mathbb{C}^{t \times 1}$, we have

\[ |u^\dagger v|^2 - |u^\dagger w|^2 | \leq \sqrt{1 - |v^\dagger w|^2}. \]

\textbf{Proof:} Let $G \triangleq vv^\dagger - ww^\dagger$ and $z \triangleq v^\dagger w$. It can be verified (after some tedious but straightforward calculations) that $G$ admits the decomposition

\[ G = \sqrt{1 - |z|^2} \left( u_1 u_1^\dagger - u_2 u_2^\dagger \right), \]

where

\[ u_1 = \alpha v - \beta v_0 \exp(-jz), \]
\[ u_2 = \beta v + \alpha v_0 \exp(-jz) \]

are orthonormal vectors with

\[ v_0 = \frac{w - vv^\dagger w}{\sqrt{1 - |z|^2}}, \]
\[ (\alpha, \beta) = \left( \sqrt{\frac{1 + \sqrt{1 - |z|^2}}{2}}, \sqrt{\frac{1 - \sqrt{1 - |z|^2}}{2}} \right). \]

We can then obtain

\[ |u^\dagger v|^2 - |u^\dagger w|^2 | = |u^\dagger Gu| \]
\[ = \sqrt{1 - |z|^2} |u_1^\dagger u_1|^2 - |u_2^\dagger u_2|^2 | \]
\[ \leq \sqrt{1 - |z|^2} (|u_1^\dagger u_1|^2 + |u_2^\dagger u_2|^2) \]
\[ \leq \sqrt{1 - |z|^2} |u|^2 \]
\[ = \sqrt{1 - |z|^2}. \]

This concludes the proof.

\textbf{REFERENCES}