

pds_bersbceo.m

Fernando Pujaico Rivera

August 24, 2015

Abstract

The function pds_bersbceo() represent the formulation of Bit Error Rate (*BER*) in the symmetric binary CEO problem.

1 Introduction

The function pds_bersbceo() in the m-file pds_bersbceo.m is defined as:

```
E = pds_bersbceo(Ps,M);
```

This function represent the formulation of *BER* in the symmetric binary CEO problem.

$$BER = \begin{cases} \sum_{k=\lfloor \frac{M}{2} \rfloor + 1}^M \binom{M}{k} (1 - P_s)^{M-k} P_s^k & \text{if } M \text{ odd} \\ \sum_{k=\lfloor \frac{M}{2} \rfloor + 1}^M \binom{M}{k} (1 - P_s)^{M-k} P_s^k & \text{if } M \text{ even} \\ + 0.5 \binom{M}{\frac{M}{2}} (1 - P_s)^{\frac{M}{2}} P_s^{\frac{M}{2}} & \end{cases} \quad (1)$$

This form is showed in [1], a similar form is presented in [2, 3].

1.1 Working with the probability $BER = P(\hat{U}_0 \neq U_0)$

In [2, 3] is considered a maximum a posteriori (*MAP*) fusion rule $f(\Omega_M)$, where the output value \hat{u}_0 of \hat{U}_0 is obtained as

$$\begin{aligned} \hat{u}_0 &= \arg_{u_0} \max P(U_0 | \Omega_M) \\ &\equiv \arg_{u_0} \max P(\Omega_M | U_0) \end{aligned} \quad (2)$$

Thus, considering that m_0 is the number of zeros in Ω_M , the decision is simplify to

$$\begin{aligned} \hat{u}_0 &= 1 \\ m_0 &\geq \lfloor \frac{M}{2} \rfloor \\ &< \\ \hat{u}_0 &= 0 \end{aligned} \quad (3)$$

In this expression is considered that if M is even and $m_0 = M/2$, the decision is arbitrarily assume that $\hat{u}_0 = 1$, so that $P(\hat{U}_0 \neq U_0)$ is $BER = 0.5$ [$P(\hat{u}_0 =$

$$0|u_0 = 1) + P(\hat{u}_0 = 1|u_0 = 0)],$$

$$BER = 0.5 \sum_{k=0}^{\lfloor \frac{M}{2} \rfloor - 1} \binom{M}{k} (1 - P_s)^k P_s^{M-k} + 0.5 \sum_{k=\lfloor \frac{M}{2} \rfloor}^M \binom{M}{k} (1 - P_s)^{M-k} P_s^k \quad (4)$$

where, $\lfloor \cdot \rfloor$ is the floor function and the value BER only is valid for values of $P_s \leq 1/2$ ¹. The Equation (4) can be sort as (1).

References

- [1] Haghighat, J.; Behroozi, Hamid; Plant, D.V., "Iterative joint decoding for sensor networks with binary CEO model," Signal Processing Advances in Wireless Communications, 2008. SPAWC 2008. IEEE 9th Workshop on , vol., no., pp.41,45, 6-9 July 2008. doi: 10.1109/SPAWC.2008.4641566
- [2] Abrardo, A.; Ferrari, G.; Martalò, M.; Perna, F. Feedback Power Control Strategies in Wireless Sensor Networks with Joint Channel Decoding. Sensors 2009, 9, 8776-8809. doi:10.3390/s91108776
- [3] Ferrari, G.; Martalo, M.; Abrardo, A.; Raheli, R., "Orthogonal multiple access and information fusion: How many observations are needed?," Information Theory and Applications Workshop (ITA), 2012 , vol., no., pp.311,320, 5-10 Feb. 2012. doi: 10.1109/ITA.2012.6181783

¹Here is important note that in [2, 3] your value ρ is equal to $1 - P_s$ here, and your result is for $\rho > 0.5$