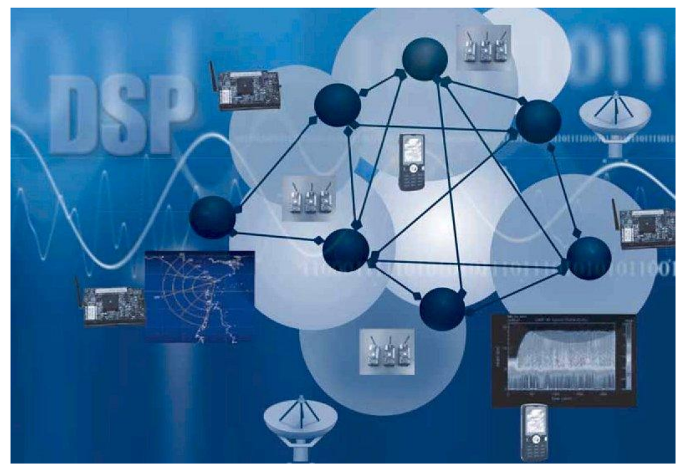


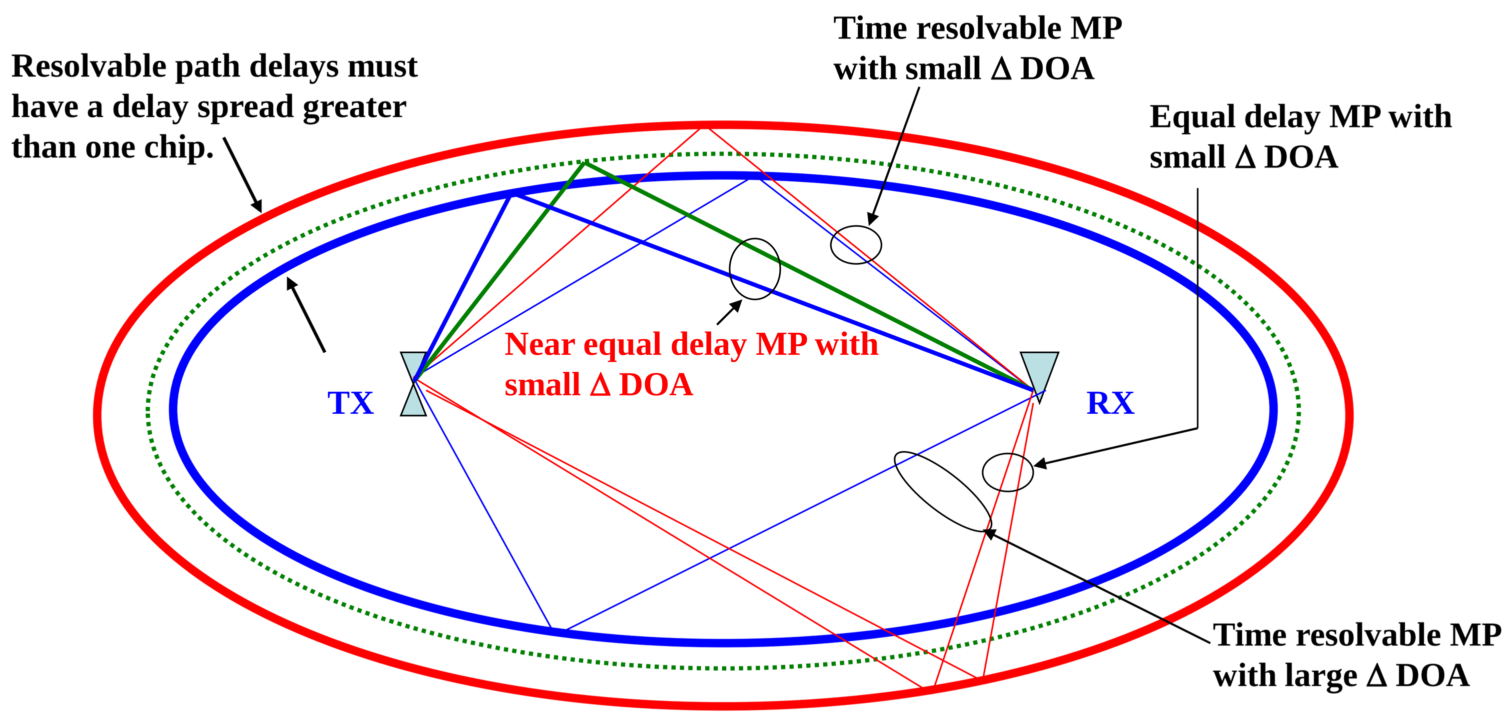
SenSIP

A New Asymmetric Correlation Kernel for GNSS Multipath Mitigation

Steven Miller, Xue Zhang, Andreas Spanias, Arizona State University
Presented by Henry Braun

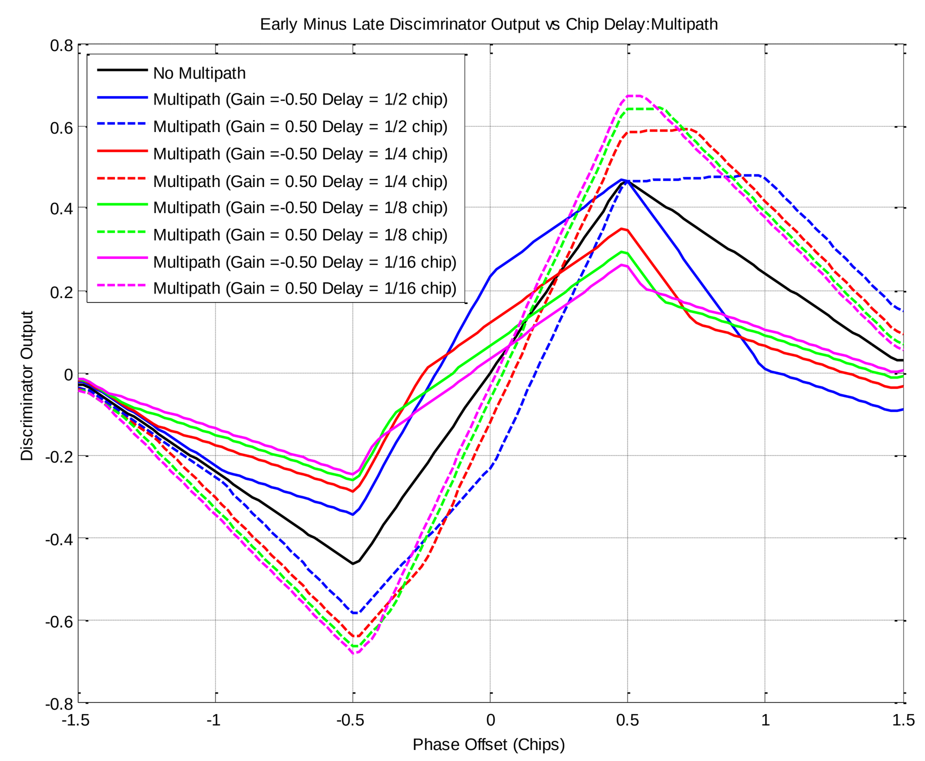
Autonomous vehicles require *cm* level positioning control

- A GNSS phase estimation problem
- Unresolved Multipath Dominates Error Budget



Each ellipsoid represents equal path delay

- Multipath introduces phase bias in early minus late (EML) correlation kernel



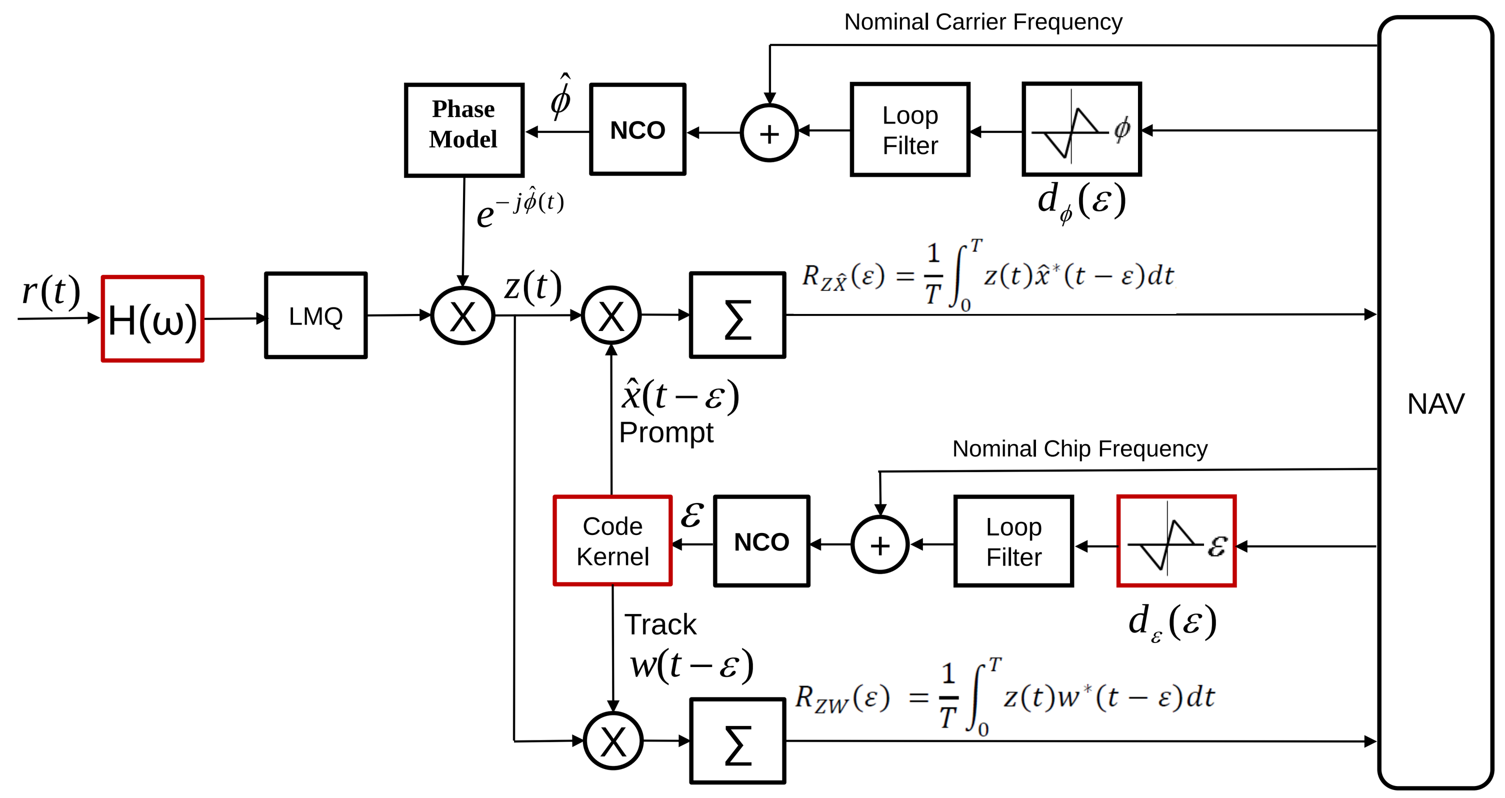
Novel Solution: Asymmetric Mass Balance Correlation Kernel

Advantages:

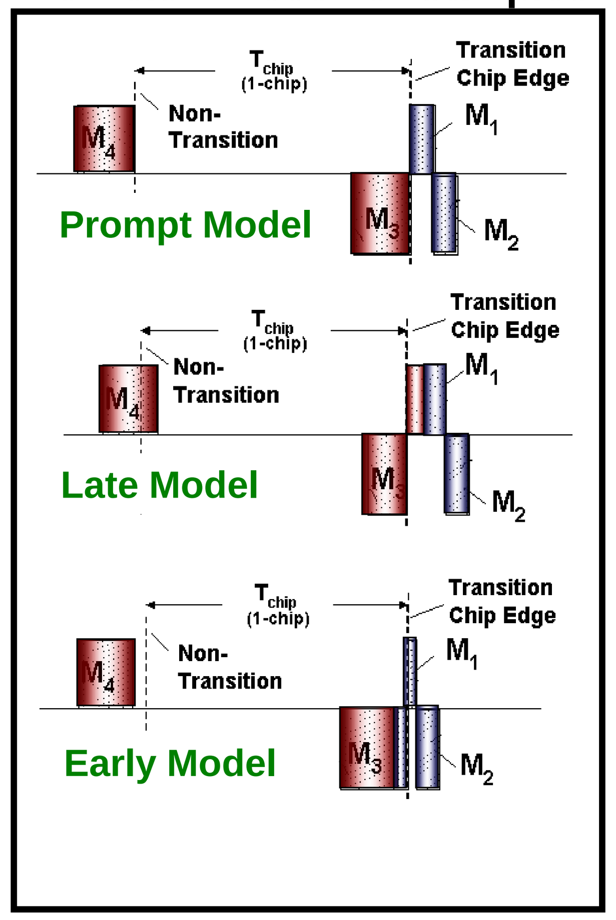
- Better multipath performance given same ROS
- Programmable and increased linear region and gain for ε > 0
- Same noise variance as EML kernel (w/ same ROS)
- Discovered and compensated for GPS L1CA unbalanced transitions and non-transitions.

Disadvantages

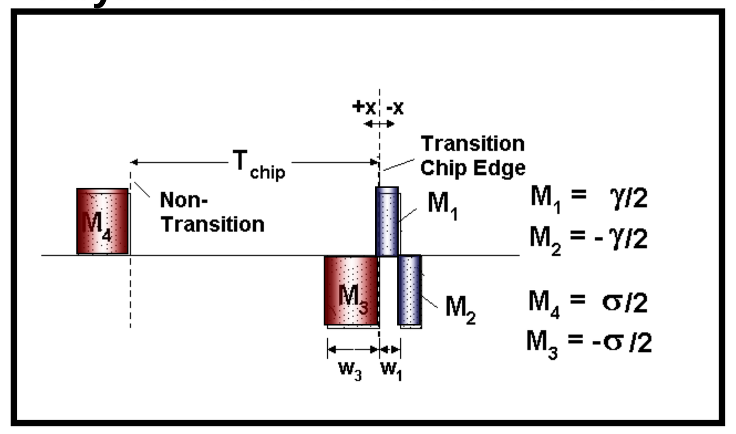
- Requires wider bandwidth
- Has smaller track range for ε < 0, but this can be overcome
- Requires an additional correlator to compute Non-Transition correlation



Kernels • Receiver Samples



Asymmetric Correlation Kernels

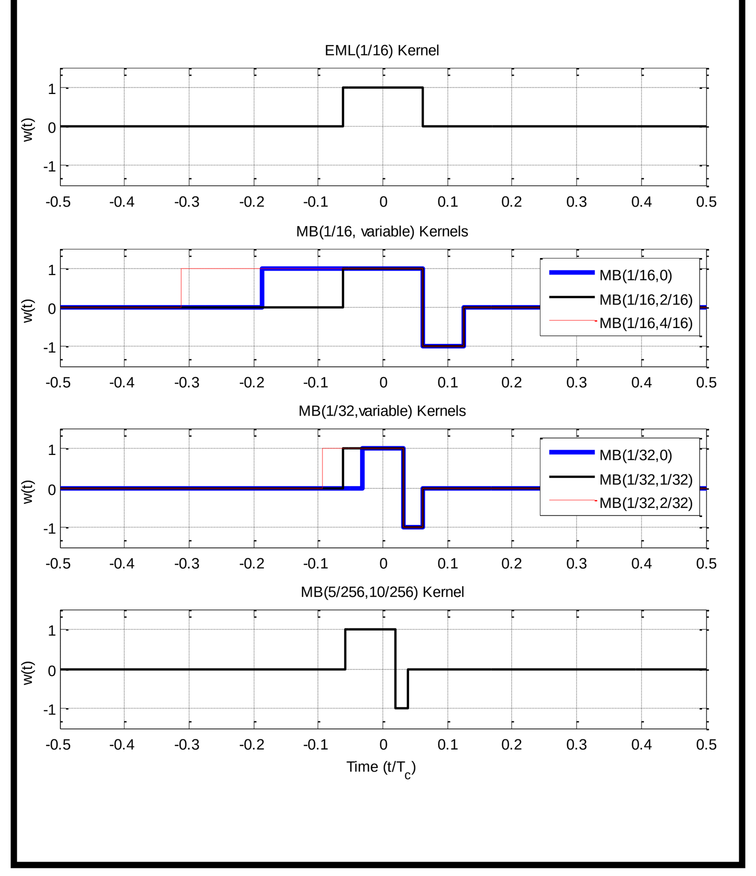


Design Equations

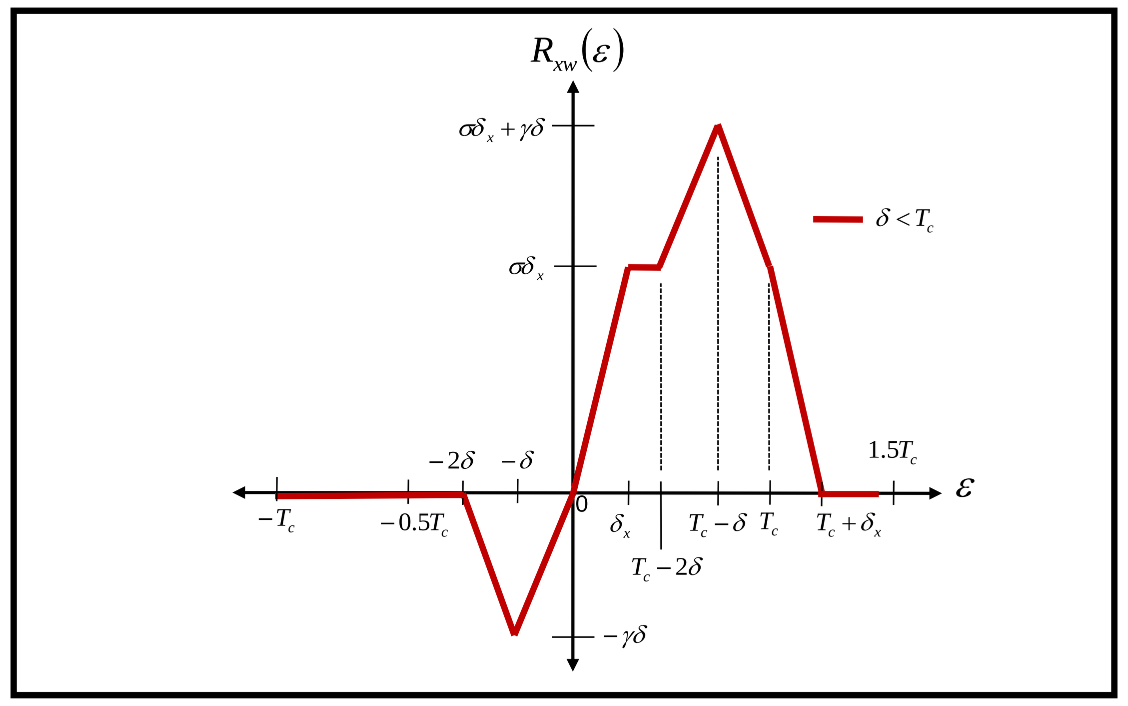
$$N_T M_1 + N_T M_2 = 0$$
$$N_T M_3 + \alpha N_N M_4 = 0$$
$$\alpha = (N_T|M_3|)/(N_N|M_4|)$$
$$\phi_{err} = \kappa(N_T S_N + N_N S_T)$$

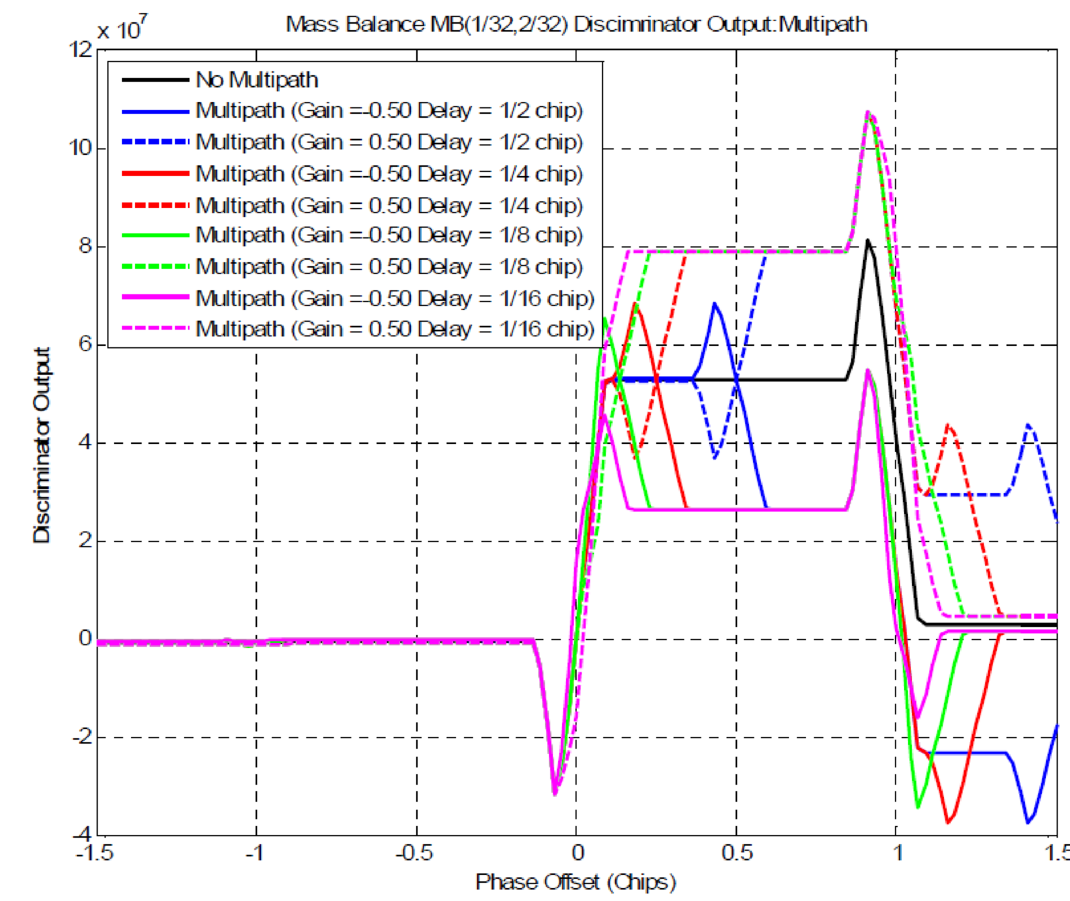
N_T = # of Transitions
N_N = # of Non-Transitions
S_k = Kernel • Sample
κ = Scalar

MB Kernel Examples

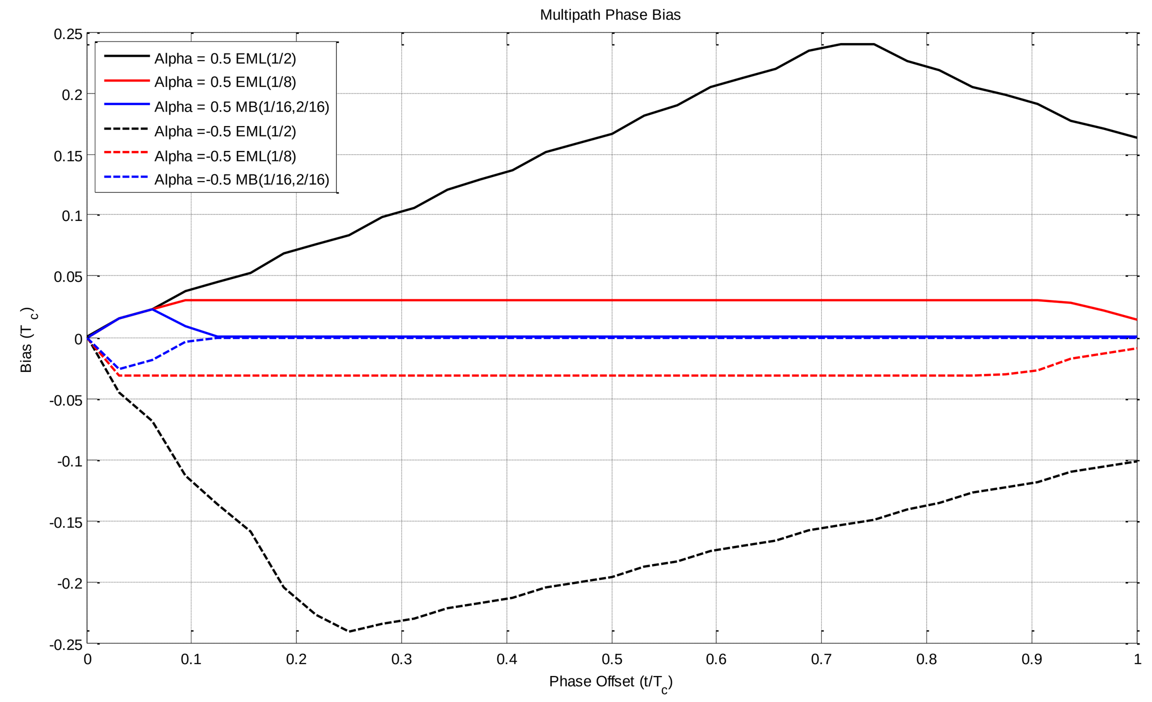


Performance





Multipath Error Envelope



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