Timing Offset Synchronization using Gardner Timing Error Detector (TED) Algorithm

Theresh Babu,Sandeep Kumar and G V V Sharma*

CONTENTS

1. GARDNER TED

Let the mth sample in the rth received symbol time slot be

$$Y_r(m) = X_r + V_r(m), \quad r = 1, \ldots, N, m = 1, \ldots, M. \tag{1.0.1}$$

where X_r is the mth transmitted symbol in the rth slot and $V_r(m) \sim \mathcal{N}\left(0, \sigma^2\right)$. The decision variable for the rth symbol is

$$U_r = Y_{r-1}\left(\frac{M}{2}\right)[Y_r(M) - Y_{r-1}(M)] \tag{1.0.2}$$