Double-strong Alternating Code Sets for Mitigation and Elimination of Unwanted Contributions from Unmatched Filtering

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Un-matched filtering and decoding of alternating codes increase the speed of an alternating code experiment by 50 % when the sampling is matched to the transmitted baud length. While the increased speed is obtained without increasing the receiver bandwidth, there will in general remain a small number of unintended contributions in lag and range. We present a methodology for constructing randomizations for alternating code sets so that the unwanted contributions change signs for different decodings of the same lag, which means that when complete range gates are formed, these contributions disappear to the greatest possible degree. We also present a methodology for selecting two such randomizations to form a code where the greatest possible number of unwanted contributions disappear in the decoding process, and where all remaining unwanted contributions are cancelled out when forming the range gate in the usual way. No special processing is required to achieve this cancellation. When code sets are picked using our methodology, only a very small number of unwanted contributions remain in the unmatched filtering profiles, and only in the partially decoded gates at either end of these lag profiles. Such contributions can be removed by solving a heavily diagonal dominated system of linear equations for the lag estimates, without significant loss of information.