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The best 2-CUSUM rules for quickest detection of two-sided alternatives in a Brownian motion model.

This work examines the problem of sequential detection of a change in the drift of a Brownian motion in the case of two-sided alternatives. Traditionally, 2-CUSUM stopping rules have been used for this problem due to their asymptotically optimal character as the mean time between false alarms tends to infinity. In this paper, we derive closed-form expressions for the first moment of a general 2-CUSUM stopping rule and its rate of change. We use these expressions to obtain explicit upper and lower bounds to both of the above quantities. Based on these expressions, we are able to identify the best 2-CUSUM stopping rule with respect to an extended Lorden criterion. Thus, it is shown that in the case of a symmetric change the best 2-CUSUM stopping rule lies in the family of harmonic mean rules whereas in the case of a non-symmetric change this is not the case. Furthermore, we discuss the existence of a modification of the 2-CUSUM stopping rule that has a strictly better performance than its classical 2-CUSUM counterpart for small values of the mean time between false alarms. We conclude with a discussion on the open problem of strict optimality in the case of two-sided alternatives. (Received August 08, 2007)