# SECOND ORDER EXPANSIONS FOR THE MOMENTS OF MINIMUM POINT OF AN UNBALANCED TWO-SIDED NORMAL RANDOM WALK

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**Abstract.** In this paper, the second order expansions for the first two moments of the minimum point of an unbalanced two-sided normal random walk are obtained when the drift parameters approach zero. The basic technique is the uniform strong renewal theorem in the exponential family. The comparison with numerical values shows that the approximations are very accurate. It is shown, particularly, that the first moment is significantly different from its continuous Brownian motion analog while the second moments are the same in the first order. The results can be used to study properties of the maximum likelihood estimator for the change point.

*Key words and phrases*: Brownian motion, ladder height and ladder epoch, strong renewal theorem.