

Fractional Brownian Motion (FBM) is a stochastic process with long-time correlations which has been used to model anomalous diffusion in numerous biological systems. Recently, it has been used to study the distribution of serotonergic fibers in the brain [1,2]. To better represent the biological process we are trying to simulate, we introduce the concept of branching FBM (bFBM). In this stochastic process, individual particles perform FBM but may randomly split into two. Here, we study bFBM in one space dimension in the subdiffusive and superdiffusive regimes, both in free space and on finite intervals with reflecting boundaries. We examine three possible types of behavior of the correlations (memory) at a branching event: both particles keep the memory of the previous steps, only one particle keeps the memory, and no particles keep the memory. We calculate the mean-square particle displacement, the corresponding probability distribution, and displacement correlation function. We find that the qualitative features of the bFBM process strongly depend on the type of branching event. We also discuss implications of our results for the distribution of serotonergic fibers, and we discuss possible future refinements of the model, including interactions between different fibers.

[1] T. Vojta, S. Halladay, S. Skinner, S. Janusonis, T. Guggenberger, R. Metzler, *Phys. Rev. E* 102, 032108 (2020).

[2] S. Janusonis, N. Detering, R. Metzler, T. Vojta, *Front. Comput. Neurosci.* 14, 56 (2020).

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