Directed Motion of a Molecular Motor Based on the Four-State Model with Unequal Substeps

WU Wei-Xia,[1] ZHAN Yong,[1] ZHAO Tong-Jun,[1,2] GUAN Rong-Hua,[1] and MEI Jun-Ping[1]

[1] School of Science, Hebei University of Technology, Tianjin 300130, China
[2] School of Electrical Engineering, Hebei University of Technology, Tianjin 300130, China

Abstract: A periodic one-dimensional four-state hopping model is proposed. In the model, the substeps between arbitrary adjacent states are unequal, and an explicit solution of the master equation is first obtained for the probability distribution as a function of the time and position for any initial distribution with all the transients included. Next, the transient behaviors in the initial period of time and the characteristic time to reach the steady state for the molecular motor are discussed. Finally, we compare the steady state results to experiments and illustrate qualitatively the kinetic behaviors of a molecular motor under external load F.

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