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An Algorithm to Compute Statistics of Stochastic Paths on Complex Landscapes MICHAEL MANHART, ALEXANDRE V. MOROZOV, Rutgers University — Many systems in physics, chemistry, and biology can be modeled as a random walk on a network subject to a potential landscape. There is great interest in understanding the statistical properties of pathways on these landscapes, especially their times, lengths, and distributions in space. The complexity of the networks and landscapes arising in many models makes them difficult to solve by traditional analytical and computational tools. Moreover, standard methods do not always provide the most relevant information for characterizing these pathways. We develop an explicitly path-based formalism for studying these problems, which we implement using a numerical dynamic programming algorithm. It is especially well-suited to studying first-passage problems and rare transitions between metastable states. This method is valid for arbitrary networks and landscapes, as well as semi-Markovian processes with non-exponential waiting-time distributions. We explore this method on a variety of simple models including regular lattices, fractals, and protein sequence evolution.

Michael Manhart
Rutgers University

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