



# A Guide to First-Passage Processes

*Sidney Redner*

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## **A Guide to First-Passage Processes** Sidney Redner

First-passage properties underlie a wide range of stochastic processes, such as diffusion-limited growth, neuron firing and the triggering of stock options. This book provides a unified presentation of first-passage processes, which highlights its interrelations with electrostatics and the resulting powerful consequences. The author begins with a presentation of fundamental theory including the connection between the occupation and first-passage probabilities of a random walk, and the connection to electrostatics and current flows in resistor networks. The consequences of this theory are then developed for simple, illustrative geometries including the finite and semi-infinite intervals, fractal networks, spherical geometries and the wedge. Various applications are presented including neuron dynamics, self-organized criticality, diffusion-limited aggregation, the dynamics of spin systems and the kinetics of diffusion-controlled reactions. First-passage processes provide an appealing way for graduate students and researchers in physics, chemistry, theoretical biology, electrical engineering, chemical engineering, operations research and finance to understand all of these systems.

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