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A Unified Framework for Processes with Discontinuous Dynamics

Many deterministic and stochastic processes that arise naturally show discontinuities in their transition rates. These discontinuities may arise due to the fact that the processes are constrained to live within a domain, as in the case of reflected diffusions, or as a result of an abrupt change in the transition rates in the interior of the domain, a characteristic exhibited by many optimally controlled processes. We describe a general unified framework for the analysis of these processes, and illustrate the application of this theory to several problems of interest.