# The relaxed stochastic maximum principle in singular optimal control of diffusions

**Authors:** Bahlali, S; Djehiche, B; Mezerdi, B.

## Abstract

This paper studies optimal control of systems driven by stochastic differential equations, where the control variable has two components, the first being absolutely continuous and the second singular. Our main result is a stochastic maximum principle for relaxed controls, where the first part of the control is a measure valued process. To achieve this result, we establish first order optimality necessary conditions for strict controls by using strong perturbation on the absolutely continuous component of the control and a convex perturbation on the singular one. The proof of the main result is based on the strict maximum principle, Ekeland's variational principle, and some stability properties of the trajectories and adjoint processes with respect to the control variable.

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