Mathematics > Probability

The vanishing of L2 harmonic one-forms on based path spaces

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We prove the triviality of the first L2 cohomology class of based path spaces of Riemannian manifolds furnished with Brownian motion measure, and the consequent vanishing of L2 harmonic one-forms. We give explicit formulae for closed and co-closed one-forms expressed as differentials of functions and co-differentials of L2 two-forms, respectively; these are considered as extended Clark-Ocone formulae. A feature of the proof is the use of the temporal structure of these path spaces to relate a rough exterior derivative operator on one-forms to the exterior differentiation operator defined earlier by Elworthy and Li, the one used to construct the de Rham complex and the self-adjoint Laplacian on L2 one-forms. This Laplacian is shown to have a spectral gap.

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