Large deviations for rough path lifts of Donsker–Watanabe's delta functions

Yuzuru Inahama (Kyushu University)

In 1993 Takanobu and Watanabe presented a large deviation principle (LDP) of Freidlin–Wentzell type for solutions of stochastic differential equations (SDEs) under the strong Hörmander condition anywhere. Unlike in the usual LDP of this type, the probability measures are not the push-forwards of the (scaled) Wiener measure, but the push-forwards of the measures of finite energy which is defined by the composition of the solutions of SDEs and the delta functions (i.e., Watanabe's pullbacks of the delta functions, also known as Donsker's delta function). One interpretation of this LDP is a generalization of the LDP of Freidlin–Wentzell type for pinned diffusion measures. This LDP looks very nice. To the author ' s knowledge, however, no proof has been given yet. In this talk we reformulate this LDP on the geometric rough path space by lifting these measures to the rough path sense and prove it rigorously by using quasi-sure analysis (which is a kind of potential theory in Malliavin calculus). Then, we obtain the LDP in Takanobu–Watanabe (1993) as a simple corollary of our main result. As a special case of this corollary, we also obtain the LDP for pinned diffusion measures under the strong Hörmander condition anywhere. (Even this one might be new.)