Zero noise limit for singular ODE regularized by fractional noise

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Abstract

A classical manifestation of regularization by noise is that adding an irregular term to an ill-posed equation may restore well-posedness (existence/uniqueness). A natural question is then, in the limit where the coefficient in front of the noise is taken to zero, whether this selects one (or several) particular solutions to the original equation (this is typically referred to as "selection by noise"). In the case of one-dimensional ODEs, perturbed by a Brownian motion, Bafico and Baldi '82 showed that this procedure selects extremal solutions, i.e. those that exit the problematic point instantly. We extend this result to the case of fractional noise (and obtain in addition some exponential concentration estimates). The main difficulty lies in the absence of the Markov property for the system. Our proof is based on the dynamical approach of Delarue-Flandoli '14, combined with recent progress in regularisation by fractional noise (Catellier-Gubinelli '16), and techniques coming from the study of ergodicity of fractional SDEs (Hairer '05, Panloup-Richard '20). Based on a joint work with Łukasz Mądry (Univ. Paris-Dauphine).

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