Bounds for RDEs with non-linear damping

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18 November 2020, 5 - 6 pm Berlin time
IRTG 2544: "Stochastic Analysis in Interaction"
— Colloquium —

Abstract

We consider a rough differential equation with a non-linear damping drift term:

$$dY(t) = -|Y|^{m-1}Y(t)dt + \sigma(Y(t))dX(t),$$

where X is a branched rough path of arbitrary regularity $\alpha > 0$, $m > 1$ and where σ is smooth and satisfies an m and α-dependent growth property. We show a strong a priori bound for Y, which includes the "coming down from infinity" property, i.e. the bound on $Y(t)$ for a fixed $t > 0$ holds uniformly over all choices of initial datum $Y(0)$.

The method of proof builds on our recent work on a priori bounds for the ϕ^4 equation in arbitrary subcritical dimension. The key new ingredient is an extension of the algebraic framework which permits to derive an estimate on higher order conditions of a coherent controlled rough path in terms of the continuity condition at lowest level.

Based on joint work with T. Bonnefoi, A. Chandra and A. Moinat.