ID de Contribution: **13** Type: **Non spécifié**

Inversion, duality and h-processes of self-similar Markov processes

lundi 30 novembre 2015 17:00 (40 minutes)

We show that any $\mathbb{R}^d$-valued self-similar Markov process X with index $\alpha > 0$ absorbed at 0, can be represented as a path transformation of some Markov additive process (MAP) (θ, ξ) in $S_{d-1} \times \mathbb{R}$. This result extends the well known Lamperti transformation. Then we prove that the same transformation of the dual MAP in the weak sense of (θ, ξ) is itself in weak duality with X, with respect to the measure $\pi(x/\|x\|)\|x\|^{\alpha-d}dx$, if and only if (θ, ξ) is reversible with respect to the measure $\pi(s)ds$, where ds is the Lebesgue measure on S_{d-1}. Besides, the dual process $\widehat{X}$ has the same law as the inversion $(X_{\gamma_t}/\|X_{\gamma_t}\|^2, t \geq 0)$ of X, where γ_t is the inverse of $t \mapsto \int_0^t \|X\|_s^{-2\alpha}\, ds$.
As an application, we prove that in some instances, the Kelvin transform of X can be obtained as an h-transform of some functional of X.

This is a joint work with Larbi Alili, Piotr Graczyk and Tomasz Zak.

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