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Lévy flights with variable stability index

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We consider a dynamical system $dX^\varepsilon(t) = -U'(X^\varepsilon(t-))\,dt + \varepsilon dH(X^\varepsilon(t-),t)$, which can be seen as a random perturbation of a deterministic dynamical system $dX^0(t) = -U'(X^0(t))\,dt$. The random process H is a Lévy flights process with a variable stability index (a stable-like process), whose instant jump distribution depends on the current position of the process.

In case of a multi-well potential U, we describe the limiting dynamics of X^ε as $\varepsilon \to 0$, in particular, transition times and probabilities between different wells. We show how the process X^ε can be used to model multi-scale phenomena.