Stochastic control for Volterra equations driven by time-changed noises

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We study a classical control problem for non classical forward dynamics of Volterra type driven by time-changed Levy noises. We consider time-changes that are the absolutely continuous type, thus exiting the framework of actual Levy framework. For this we shall consider different information flows and, when necessary, consider these flows either as enlarged filtrations or as partial information. Being the system possibly non-Markovian, we prove stochastic maximum principles of both Pontryagin and Mangasarian type. For this we shall study backward Volterra integral equations with time-change. We illustrate our results with an application to mean-variance portfolio selection.