Miller, B. M.; **Stepanyan, K. V.**
Optimal linear filtering in systems with noise in observations dependent on signal and estimate. (English. Russian original) Zbl 1062.93040

The usual underlying idea of traditional approaches to observation control is the conditional Gaussian filtering.

In practice, however, there are several problems which do not fall into this class of conditionally Gaussian models, among them namely the problems in which the noises in the observations depend on the state of the non-observable process and its estimate.

This class of problems is studied here. To be more precise, let a partially observable system be described by the multi-dimensional Itô equations $dX_t = X_t dA_t + d\xi_t$, $dY_t = H_t X_t dt + d\eta_t$, where $X_0 = x_0$ is Gaussian, ξ is a Gaussian martingale and A is a matrix-valued bounded process of bounded variation; X is interpreted as the non-observable process. Given a Brownian motion W independent of ξ and x_0, the observation process Y is driven by the Itô integral process $\eta_t = \int_0^t G(s, X_s, \widehat{X}_s) dW_s$, depending on the non-observable process X and its estimate $\widehat{X}$. The authors of the paper study linear estimates $\widehat{X}$ of the type $\widehat{X}_t = F_t + \int_0^t L(t,s) dY_s$, where F and L are deterministic functions. They show that the linear estimate $\widehat{X}$ minimizing the quadratic estimation error matrix is a Kalman-type estimate and they determine an explicit form of the optimal coefficient of this Kalman-type estimate.

After that, the authors study the above partially observable system but now supplemented with a control term in the state equation, and they associate a quadratic cost function. Its minimal value and the optimal control are characterized with the help of Riccati-type equations.

Reviewer: Rainer Buckdahn (Brest)

MSC:

93E11 Filtering in stochastic control theory
93E20 Optimal stochastic control

Keywords:

optimal linear filtering; Kalman estimate; Zakai equation; Riccati equation; state dependent observation noise; stochastic optimal control; partially observable system