

Shiryaev, A. N.; Yor, M.

On the problem of stochastic integral representations of functionals of the Brownian motion. I. (English. Russian original) [Zbl 1057.60057](#)

Theory Probab. Appl. 48, No. 2, 304-313 (2003); translation from *Teor. Veroyatn. Primen.* 48, No. 2, 375-385 (2003).

The stochastic integral representation is well known, i.e. every quadratic integrable functional of the Brownian motion can be represented as the sum of its mean value and a stochastic integral w.r.t. the Brownian motion. Nevertheless, finding explicit representations is uneasy and not much studied. This lucid paper considers explicit representations of functionals of the “maximal” type: S_T and S_{T-a} , where $S_t = \max_{s < t} B_s$, T is constant and $T-a$ is the first hitting time of a . Among other results the representation of $I(T_a < T)$ is also given.

It is a pleasure to read the paper, which only relies on the Itô formula and elementary calculations. More technical tools like Malliavin calculus and the Clark-Ocone formula are not used. The paper is the first in a series of two. The second paper considers the stochastic integral representation of S_{g_T} and S_{θ_T} . Here g_T is the time of the last zero of the Brownian motion on $[0, T]$, and θ_T is the time when the Brownian motion achieves its maximal value on $[0, T]$. Both g_T and θ_T are the non-Markov times.

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60H05 Stochastic integrals
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