



CHARLES UNIVERSITY
Faculty of mathematics
and physics

Stochastic Differential Equations with Gaussian Noise and Their Applications

Referee Report

August 31, 2020

This thesis studies stochastic differential equations with multivariate fractional Brownian motions with possibly different Hurst indices in different coordinates. Two results are shown. The first result is the existence of a weak solution to an SDE with a drift coefficient that can be written as a sum of a regular and a singular part and a diffusion coefficient that is dependent on time and satisfies suitable conditions. The second result is the application of the Girsanov-type theorem to find the maximum likelihood scalar estimator that appears in the drift of an SDE with additive noise.

The thesis itself is mathematically very heavy with a high level of detail. The cited literature is rather extensive and many results are used in the thesis and properly cited. However, the original results of the author and the known results are mixed throughout the text. Thus I would suggest to point out all the novel contributions during the thesis defense and separate the results that are known from the previous literature. The text is written in a solid English with some occasional minor typos (like “equation [1]” on page 2) or sloppy formulations (like “The topic of existence of . . .” on page 3 instead of a more straightforward “Existence of . . .”), but in general the text is fine.

As the determination of the maximum likelihood estimator of the SDE drift term is one of the two main topics of the thesis, the obvious question is whether a Bayesian approach for the drift estimation is possible. Something along the lines of “Chernoff, H. (1961). Sequential tests for the mean of a normal distribution. In Proceedings of the fourth Berkeley symposium on mathematical statistics and probability (Vol. 1, pp. 79-91). University of California Press.” The problem studied in the thesis is obviously slightly different, but one can imagine that the Bayesian approach to estimation of the drift parameter is in principle possible. A short clarification of this point is welcomed during the defense.

Summary: The thesis satisfies conditions of a master thesis and I recommend that it is **accepted as such**. The thesis is well written and the author has proved the

competence of analytical thinking.

A handwritten signature in blue ink, appearing to read 'Jan Vecer', with a stylized flourish at the end.

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