Discussiones Mathematicae
Probability and Statistics 35 (2015) 7–9
doi:10.7151/dmps.1178

SEMIMARTINGALE MEASURE IN THE INVESTIGATION OF STRATONOVICH-TYPE STOCHASTIC INTEGRALS AND INCLUSIONS

Joachim Syga

Faculty of Mathematics, Computer Science and Econometrics,
University of Zielona Góra,
ul. prof. Z. Szafrana 4a, 65–516 Zielona Góra, Poland

e-mail: j.syga@wmie.uz.zgora.pl

Abstract

A random measure associated to a semimartingale is introduced. We use it to investigate properties of several types of stochastic integrals and properties of the solution set of Stratonovich-type stochastic inclusion.

Keywords: forward, backward and symmetric integral, time-reversible process, semimartingale measure, set-valued stochastic integral, Stratonovich inclusion.

2010 Mathematics Subject Classification: 28A25, 47H04, 60H05, 93C30, 93E03.

References

[1] K.K. Aase and P. Guttrup, *Estimation in models for security prices*, Scand. Actuarial J. **3/4** (1987), 211–225.

[2] N.U. Ahmed, *Nonlinear stochastic differential inclusions on Banach spaces*, Stoch. Anal. Appl. **12** (1994), 1–10.

[3] N.U. Ahmed, *Impulsive perturbation of C_0 semigroups and stochastic evolution inclusions*, Discuss. Math. DICO **22** (1) (2002), 125–149.

[4] N.U. Ahmed, *A brief summary of optimal control of uncertain systems governed by parabolic inclusions*, Arab. J. Sci. Eng. ASJE Math. **34** (1D) (2009), 13–23.

[5] J.P. Aubin and A. Cellina, Differential Inclusions (Springer-Verlag, Berlin, Heidelberg, New York, 1984).

[6] J.P. Aubin and H. Frankowska, Set-Valued Analysis (Birkhäuser, Boston - Basel - Berlin, 1990).

[7] J.P. Aubin and G. Da Prato, *The viability theorem for stochastic differential inclusions*, Stoch. Anal. Appl. **16** (1998), 1–15.

[8] E.P. Avgerinos and N.S. Papageorgiou, *Random nonlinear evolution inclusions in reflexive Banach spaces*, Proc. Amer. Math. Soc. **104** (1988), 293–299.

[9] K.L. Chung and R.J. Williams, Introduction to stochastic integration (Birkhäuser, Boston - Basel - Berlin, 1990).

[10] G. Da Prato and H. Frankowska, *A stochastic Filippov theorem*, Stoch. Anal. Appl. **12** (4) (1994), 409–426.

[11] D. Duffie, Dynamic Asset Pricing Theory, Princeton Univ. Press (Princeton, New Jersey, 1996).

[12] M. Errami, F. Russo and P. Vallois, *Itô's formula for $C^{1,\lambda}$-functions of a càdlàg process and related calculus*, Probab. Theory Relat. Fields **122** (2002), 191–221.

[13] A. Fryszkowski, *Continuous selections of Aumann integrals*, J. Math. Anal. Appl. **145** (2) (1990), 431–446.

[14] A. Góralczyk and J. Motyl, *Stratonovich stochastic inclusion*, Dynam. Systems Appl. **18** (2) (2009), 191–204.

[15] F. Hiai and H. Umegaki, *Integrals, conditional expectations and martingales of multivalued functions*, J. Multivar. Anal. **7** (1977), 149–182.

[16] M. Kisielewicz, *Properties of solution set of stochastic inclusions*, J. Appl. Math. Stoch. Anal. **6** (3) (1993), 217–236.

[17] M. Kisielewicz, *Existence theorem for nonconvex stochastic inclusions*, J. Appl. Math. Stoch. Anal. **7** (2) (1994), 151–159.

[18] M. Kisielewicz, *Set-valued stochastic integrals and stochastic inclusions*, Stoch. Anal. Appl. **15** (5) (1997), 783–800.

[19] M. Kisielewicz, Differential Inclusions and Optimal Control, Kluwer Acad. Publ. and Polish Sci. Publ. (Warszawa - Dordrecht - Boston - London, 1991).

[20] M. Kisielewicz, M. Michta and J. Motyl, *Set valued approach to stochastic control. Part I (Existence and Regularity Properties)*, Dynam. Systems Appl. **12** (2003), 405–432.

[21] M. Kisielewicz, M. Michta and J. Motyl, *Set valued approach to stochastic control. Part II (Viability and Semimartingale Issues)*, Dynam. Systems Appl. **12** (2003), 433–466.

[22] M. Michta, *On set-valued stochastic integrals and fuzzy stochastic equations*, Fuzzy Sets and Systems **177** (2011), 1–19.

[23] M. Michta and J. Motyl, *Differentiable selections of multifunctions and their applications*, Nonlinear Anal. **66** (2) (2007), 536–545.

[24] M. Michta and J. Motyl, *Martingale problem to Stratonovich stochastic inclusion*, Nonlinear Anal. **71** (12) (2009), e1307–e1311.

[25] J. Motyl, *On the solution of a stochastic differential inclusion*, J. Math. Anal. Appl. **192** (1) (1995), 117–132.

[26] J. Motyl, *Note on strong solutions of a stochastic inclusion*, J. Appl. Math. Stoch. Anal. **8** (3) (1995), 291–297.

[27] J. Motyl, *Existence of solutions of set-valued Itô equation*, Bull. Acad. Pol. Sci. **46** (1998), 419–430.

[28] J. Motyl and J. Syga, *Properties of set-valued stochastic integrals*, Discuss. Math. Probab. Stat. **26** (2006), 83–103.

[29] J. Motyl and J. Syga, *Selection property of Stratonovich set-valued integral*, Dynamics of Continuous, Discrete and Impulsive Systems **17** (2010), 431–443.

[30] P. Protter, Stochastic Integration and Differential Equations, Springer-Verlag, 2nd Edition, Version 2.1 (Berlin - Heideberg - New York, 2005).

[31] D. Repovš and P.V. Semenov, Continuous selections of multivalued mappings, Kluwer Academic Publishers (Dordrecht, Boston, London, 1998).

[32] F. Russo and P. Vallois, *Forward, backward and symmetric stochastic integration*, Probab. Theory Relat. Fields **97** (1993), 403–421.

[33] F. Russo and P. Vallois, *The generalized covariation process and Ito formula*, Stochastic Process. Appl. **59** (1995), 81–104.

[34] J. Syga, *Application of semimartingale measure to the investigation of stochastic inclusion*, Dynam. Systems Appl. **21** (2012), 393–406.

Received 30 September 2014